Workshop Manual

Fox 2004 ➤ , Fox 2010 ➤ , Fox 2014 ➤ ,
Gol 1995 ➤ , Gol 1999 ➤ , Gol 2006 ➤ ,
Gol 2009 ➤ , Gol 2013 ➤ , Gol 2017 ➤ ,
Gol 2019 ➤ , Golf 1999 ➤ , Golf 2007 ➤ ,
Golf 2016 ➤ , Golf BR 2018 ➤ ,
Kombi 1997 ➤ , Parati 1999 ➤ ,
Parati 2006 ➤ , Polo 2003 ➤ ,
Polo 2007 ➤ , Polo 2012 ➤ ,
Polo BR 2018 ➤ , Polo Sedan 2003 ➤ ,
Polo Sedan 2007 ➤ ,
Polo Sedan 2012 ➤ , Santana 1991 ➤ ,
Saveiro 2000 ➤ , Saveiro 2006 ➤ ,
Saveiro 2010 ➤ , Saveiro 2014 ➤ ,
Saveiro 2017 ➤ , SpaceFox 2006 ➤ ,
SpaceFox 2011 ➤ , T-Cross BR 2020 ➤ ,
Virtus BR 2018 ➤ , Voyage 2009 ➤ ,
Voyage 2013 ➤ , Voyage 2017 ➤ ,
Voyage 2019 ➤ , up! 2014 ➤ ,
up! BR 2018 ➤

Electrical system - General information

Edition 07.2019

List of Workshop Manual Repair Groups

Repair Group

27 - Starter, current supply, CCS

92 - Windscreen wash/wipe system

94 - Lights, bulbs, switches - exterior

96 - Lights, bulbs, switches - interior

97 - Wiring

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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27 – Starter, current supply, CCS

1 Battery -A-

(VRL012849; Edition 07.2019)

⇒ “1.1 Important information concerning battery A ”, page 1

⇒ “1.2 Battery A types”, page 2

⇒ “1.3 Warning notes and safety norms”, page 3

⇒ “1.4 Battery A connection terminals”, page 6

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

In order to avoid damage to the Battery - - or to the vehicle, pay attention to the notes on Battery - A- ⇒ page 2 types.

Note

Due to manufacturing reasons, different types of Battery - A- are installed. The work instructions herein described refer to all types of Battery - A- . Specific work deviations and instructions should be deduced for each type of Battery - A- .

1.1 Important information concerning battery -A-

To ensure a long use lifespan of the Battery - A- , check and the carry out maintenance as described in this Repair Manual.

Besides having the function of supplying energy to start the engine, the Battery - A- has other functions, such as storing and supplying energy to the vehicle's entire electrical network.

Note

Regarding the INMETRO resolution (Notice 299/12), all automotive batteries traded in the Brazilian market as of June 14, 2014 must be approved and display the INMETRO logo in its respective label.

1.2 Battery -A- types

⇒ “1.2.1 Low maintenance batteries”, page 2

⇒ “1.2.2 Standard battery with colour codes”, page 2

⇒ “1.2.3 Enhanced battery with colour codes”, page 2

⇒ “1.2.4 Sealed battery (AGM battery)”, page 3

1.2.1 Low maintenance batteries

Low maintenance Battery - A- with liquid electrolyte (standard battery). This Battery - A- is identifiable by the removable cell caps.

This type of Battery - A- requires the electrolyte level to be checked at regular intervals and, if necessary, to be replenished with distilled water.

These batteries are typically equipped with an inspection window, which, by means of a colour code, supplies information about the load condition and the electrolyte level of the Battery - A- .

1.2.2 »Standard« battery with colour codes

Maintenance-free battery with liquid electrolyte (wet battery).

> WARNING
>
> *Batteries with colour codes showing a bright yellow colour must not be tested or charged. Do not jump start the vehicle!*
>
> *Risk of explosion during testing, charging or jump starting.*
>
> *These batteries must be replaced.*

This battery is equipped with a colour code system. Colour codes provide information regarding battery charging and acid levels. Colour codes - check ⇒ page 10 .

1.2.3 »Enhanced« battery with colour codes

Maintenance-free battery with liquid electrolyte (wet battery).

> Caution
>
> *Do not remove any tags and always supply the battery with distilled water. Perform visual inspections only. Refer to the battery testing chapter ⇒ page 7 .*

> WARNING
>
> *Batteries with colour codes showing a bright yellow colour must not be tested or charged. Do not jump start the vehicle!*
>
> *Risk of explosion during testing, charging or jump starting.*
>
> *These batteries must be replaced.*

This battery is used for special requirements in certain vehicles equipped with Start-Stop system. The battery type is indicated in the “EFB” lettering over the battery cover. “EFB” stands for »Enhanced Flooded Battery«.

“EFB” batteries can only be replaced with other “EFB” batteries.

"EFB" batteries have a colour code system to control acid levels.

Colour codes - check ⇒ page 9 .

Note

"EFB" batteries are used since 05/2011 in smaller Otto cycle engines with Start-Stop systems and manual gearbox.

1.2.4 Sealed battery (AGM battery)

Maintenance-free batteries with electrolyte and without colour codes.

Lead-acid batteries in which the electrolyte is fixated in absorbent glass mats (AGM). The battery is sealed and equipped with valves.

AM stands for Absorbent Glass Mat.

Due to the determination of electrolytes, these batteries cannot have any colour coding. Sealed batteries are identified by the AGM lettering over the battery.

Note

- *When replacing sealed batteries, a dry battery must be used.*
- *When replacing this battery, the battery control unit - J367- must be adjusted.*

– Connect the vehicle diagnostic tester .

– Adjust the Battery control unit - J367- ⇒ Vehicle diagnostic tester.

1.3 Warning notes and safety norms

⇒ "1.3.1 Risks inherent to the handling of automotive batteries", page 3

⇒ "1.3.2 Safety symbols on the Battery A ", page 5

⇒ "1.3.3 Airbag system work", page 5

1.3.1 Risks inherent to the handling of automotive batteries

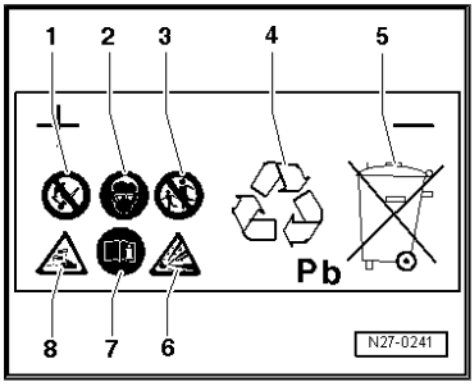
Knowing and avoiding the risks:

Handling batteries can present some risks. However, these risks can be avoided as long as the information included with the Battery - A- , in the owner's manual/instructions and use, and in the ELSA system is followed.

WARNING

- *Personnel without training or experience must only carry out work involving batteries under the supervision of specialized personnel, such as a duly authorized and licensed mechanic or an automotive electrician.*
- *The electrolyte is extremely corrosive. In the event that the batteries are incorrectly handled, there is a risk of people being exposed to their harmful effects. For this reason, means of neutralizing the effects caused by acid must be available, such a soap solution.*
- *In the event that the electrolyte of the Battery - A- is spilled, burns may be caused to skin and corrosion to the vehicle, and safety components may be damaged.*
- *The gas that forms during transportation and gas exiting the Battery - A- vent after transportation is explosive. In extreme cases, incorrect handling may cause the battery - A- to explode.*
- *Batteries whose magic eyes are colourless or of a light yellow colour must be replaced. They must not be checked or charged, nor used for crash starting. There is still a danger of explosion during verification, charging or crash starting.*
- *Fires, sparks, open flames and smoking are prohibited near the Battery - A- . Avoid sparks and electrostatic discharges when handling cables and electrical devices. Always touch the car body before touching the Battery - A- .*
- *Only carry out work on batteries in well-ventilated places suitable for this purpose.*

1.3.2 Safety symbols on the Battery - A-



Safety symbols:

1 - Producing fire, sparks, open flames and smoking is prohibited:

– Avoid sparks and electrostatic discharges when handling cables and electrical devices.

– Avoid short circuits (never lay tools on the top of a battery).

2 - Wear goggles.

3 - Keep children away from the acid and the batteries.

4 - Disposal:

– Dispose of old batteries at a battery collection centre (supplier).

5 - Never dispose of a damaged battery - A- together with domestic waste.

6 - Risk of explosion:

– A highly explosive mix of oxy-hydrogen gas is produced when charging batteries.

7 - Follow the instructions printed on the Battery - A- , in the electrical system repair manual (ELSA) and in the operations manual.

8 - Danger of chemical corrosion:

– The Battery - A- acid is highly corrosive, therefore, wear protection goggles and gloves.

– Do not overturn the Battery - A- . Acid can leak from the degassing openings.

1.3.3 Airbag system work

WARNING

When working on the airbag system (pyrotechnical components, Airbag control unit - J234- , cabling), the earth wire must be disconnected while the ignition is switched on.

- *Next, cover the negative terminal.*
- *Wait 10 seconds after disconnecting the battery.*
- *The battery must be connected while the ignition is switched on.*
- *No one must be inside the vehicle when connecting the battery.*

In this case, ensure there is no one in the area of operation of airbags and belt tensioners.

If the ignition is not switched off after reconnecting the battery - warning lamps do not light up in the instrument cluster control panel - the ignition (key/button) can only be switched on while sitting in the driver's seat, in the rearmost position.

1.4 Battery -A- connection terminals

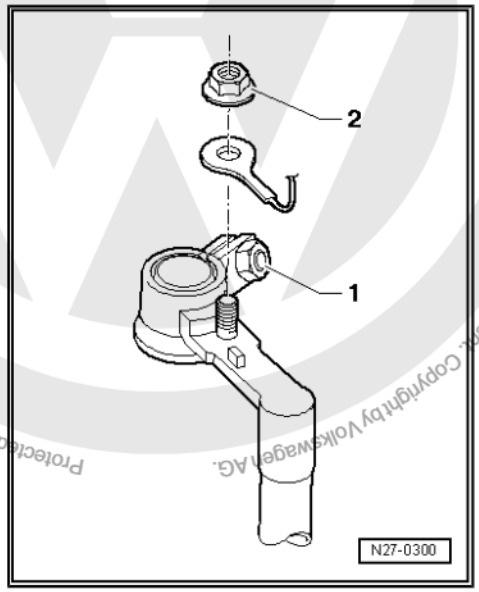
Caution

To avoid damage to the terminals and poles of Battery - A- , the following instructions must be adhered to:

- *The terminals of the Battery - A- poles must be manually and effortlessly attached, in order to avoid damage to the Battery - A- housing.*
- *Do not lubricate the poles of the battery - A- .*
- *Install the terminals on the poles of the battery - A- so that the pole of the battery - A- is aligned with the terminal or slightly past it.*
- *Upon reconnecting the Battery - A- , check the vehicle equipment (radio, clock, power locks and windows, etc.) according to the Operations Manual and/or instructions for use.*

Note

The tightening torque of the Battery - A- terminals-1- and of the additional terminals -2- are indicated in the table "Tightening torques - battery", indicated in the respective chapters of each vehicle.



2 Battery -A- - check

⇒ “2.1 Battery A checking sequence”, page 7

⇒ “2.2 Check visually”, page 8

⇒ “2.3 Battery degassing and replacement instructions”, page 9

⇒ “2.4 Check the battery A with inspection window”, page 9

⇒ “2.5 Checking the low-maintenance battery A ”, page 11

⇒ “2.6 Current consumption - test”, page 14

⇒ “2.7 Check the charge of the Battery A ”, page 16

⇒ “2.8 Charge acceptance test”, page 27

⇒ “2.9 Check the resting current of the battery”, page 29

⇒ “2.10 Check the final battery charge”, page 31

⇒ “2.11 Checking the resting voltage of batteries (unused or stored vehicles)”, page 33

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

In order to avoid damage to the Battery - - or to the vehicle, pay attention to the notes on Battery - A- ⇒ page 2 types.

Note

Refer to the ⇒ Maintenance ; Booklet Battery chapter for the corresponding vehicle.

2.1 Battery -A- checking sequence

⇒ “2.1.1 Battery with colour codes - test”, page 7

⇒ “2.1.2 Sealed battery (AGM battery) - test”, page 8

2.1.1 Battery with colour codes - test

WARNING

Risk of injuries! Follow all safety instructions ⇒ page 3 !

Carry out visual inspections in the following order:

1. Visual inspection ⇒ page 8
2. Test the colour codes “3 colours” ⇒ page 10 or “2 colours”, ⇒ page 10

> WARNING
>
> *Batteries with colour codes showing a bright yellow colour must not be tested or charged. Do not jump start the vehicle!*
>
> *Risk of explosion during testing, charging or jump starting.*
>
> *These batteries must be replaced.*

3. Battery test with the Battery test - VAS 6161- ⇒ page 22 .
4. Depending on the results of the battery inspection, “carry out electrical current use inspection” ⇒ page 14 .

2.1.2 Sealed battery (AGM battery) - test

Carry out visual inspections in the following order:

1. Visual inspection ⇒ page 8
2. Battery check with the Battery test - VAS 6161- . ⇒ page 22
3. Depending on the results of the battery inspection, “carry out electrical current use inspection” ⇒ page 14 .

2.2 Check visually

> WARNING
>
> *Risk of injuries! Follow all safety instructions ⇒ page 3 !*

Before proceeding, first visually inspect exterior conditions, connections and proper seating of covers in the battery breathers.

Note

Refer to the ⇒ Maintenance ; Booklet Battery chapter for the corresponding vehicle.

> Caution
>
> - *Improper battery seating may cause damages.*
> - *Vibration damages reduce the battery service life and represent a risk of explosion, damages to grid plates and the fastening trim could damage the battery housing.*
> - *Check if the battery is secured in place; if necessary, tighten the fastening bolt to the specified torque.*

Follow the visual inspection checklist below:

- Check whether the Battery housing is damaged. Housing damages could cause acid leaks. Leaked battery acid can cause serious damages to the vehicle. Immediately apply acid converter or bleached soap to affected components.
- Check for damages in battery terminals (battery connections). Damaged terminals may affect battery terminal contacts. Always apply the tightening torque specified in the vehicle's “electrical installation” service manual when connecting battery terminals. Conductors may burn if the battery terminals are not correctly engaged and tightened. This can lead to se-

rious electrical operating faults. This ultimately compromises safe vehicle operation.

- Check if the breather hose and the cover are secured in place. In vehicles where the battery is located in the passenger compartment or luggage compartment, ensure the breather hose is secured in place. Ensure there is no breather opening around the positive terminal. Breather openings in this area must be sealed with a cover. The breather hose must be connected to the open breather in the negative terminal area. Refer to chapter ⇒ page 9

2.3 Battery degassing and replacement instructions

- The location of the breather is a major safety factor for battery degassing!
- In applications using a breather hose, ensure the hose is secured in place and check if the breather opening on the opposing side is closed.
- When replacing the vehicle battery, ensure there is no open breather in the positive terminal area. Otherwise, these openings must be closed with a cover and the breather opening in the negative terminal area must be open.
- In vehicles with AGM battery installed outside the engine compartment, ensure the replacement battery is also an AGM battery.
- When replacing the AGM battery, the battery control unit - J367- must be adjusted.
- Connect the vehicle diagnostic tester .
- Adjust the Battery control unit - J367- ⇒ Vehicle diagnostic tester.
- All AGM, EFB+ and EFB batteries have a lidless protection cover moulded into the positive terminal. The breather opening on the positive terminal is closed by default.

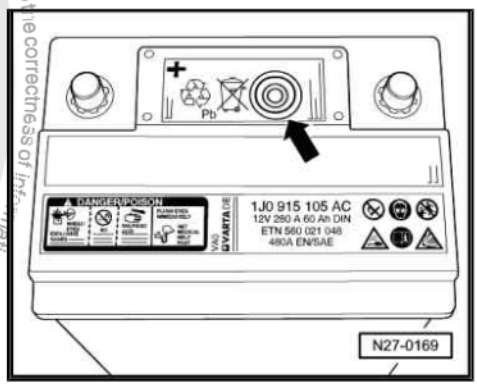
In case of original spare batteries with the following numbers, a red cover must be available on the positive or negative terminals. If not, this cover must be subsequently inserted. Original Part No. 000.915.506

2.4 Check the battery -A- with inspection window

The inspection window -arrow- supplies information on the charge and the level of electrolyte in the battery - A- .

For this type of verification, there are three kinds of battery with inspection visors (magic eye):

- Maintenance-free batteries with inspection windows “3 colours” ⇒ page 10 .
- Maintenance-free batteries with inspection windows “2 colours” ⇒ page 10 .
- Low maintenance batteries ⇒ page 11 .



2.4.1 Check the battery -A- with battery inspection window “3 colours”

> **WARNING**
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

General information on the inspection window (magic eye):

Valid for all batteries with the index “1J0”, “5Z0”, “5U0”, “000”.

The inspection window supplies information on the charge and the level of electrolyte in the Battery - A- .

– Before carrying out a visual check, lightly and carefully tap the inspection window with a screwdriver handle.

By doing this, any air bubbles that might distort reading will be eliminated and the colour code of the window will be more accurate.

Note

- *Especially when a Battery - A- was recharged, that is, even when the Battery - - was charged during driving, air bubbles can form under the inspection window. They distort the colour indication in the inspection window.*
- *Since the inspection window is located on an individual Battery - A- cell, the code refers only to that cell. An exact assessment of the battery condition is only possible running a charge test on the battery - A- ⇒ page 7 .*
- *The inspection window may be located in different positions on the Battery - A- .*

There are three different colour codes:

- »Green« the Battery - A- is sufficiently charged.
- »Black« the battery - A- is partly charged, charge condition < 65% or flat; the battery - A- needs charging.
- »Colourless or yellow« the electrolyte level is too low; the Battery - A- needs replacing.

2.4.2 Check the battery -A- with battery inspection window “2 colours”

> **WARNING**
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

General information on the inspection window (magic eye):

Valid for all batteries with the index “5K0”.

The inspection window supplies information on the charge and the level of electrolyte in the Battery - A- .

The charge condition of the Battery - A- can no longer be read through the inspection window, use the charge verifier ⇒ page 16 .

– Before carrying out a visual check, lightly and carefully tap the inspection window with a screwdriver handle.

By doing this, any air bubbles that might distort reading will be eliminated and the colour code of the window will be more accurate.

Note

- *Especially when a Battery - A- was recharged, that is, even when the Battery - - was charged during driving, air bubbles can form under the inspection window. They distort the colour indication in the inspection window.*
- *Since the inspection window is located on an individual Battery - A- cell, the code refers only to that cell. An exact assessment of the battery - A- condition is only possible when a charge test is carried out on the battery - A- ⇒ page 7 .*
- *The inspection window may be located in different positions on the Battery - A- .*

There are two different colour codes:

- »Black« the Battery - A- is sufficiently charged.
- »Colourless or yellow« the electrolyte level is too low; the Battery - A- needs replacing.

2.5 Checking the low-maintenance battery - A-

⇒ “2.5.1 Checking the electrolyte level”, page 12

⇒ “2.5.2 Top it up with distilled water”, page 12

⇒ “2.5.3 Verifying the density of the electrolyte”, page 13

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

This type of Battery - A- requires the electrolyte level to be checked at regular intervals and, if necessary, to be replenished with distilled water.

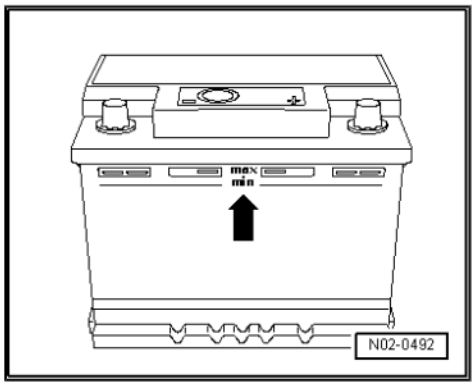
Check the electrolyte level ⇒ page 12 .

Top it up with distilled water ⇒ page 12 .

2.5.1 Checking the electrolyte level

Check the electrolyte level in the battery housing:

– Check the electrolyte level against the (MAX and MIN) marks -arrow- in the Battery - A- housing.



The electrolyte level is correct when it is at the MAX mark.

If the electrolyte level is below the MAX mark:

– Top it up with distilled water ⇒ page 12 .

Check the electrolyte level in the cells:

– Turn off the ignition and all electrical equipment.

– Remove, if applicable, the protective stickers on the removal caps.

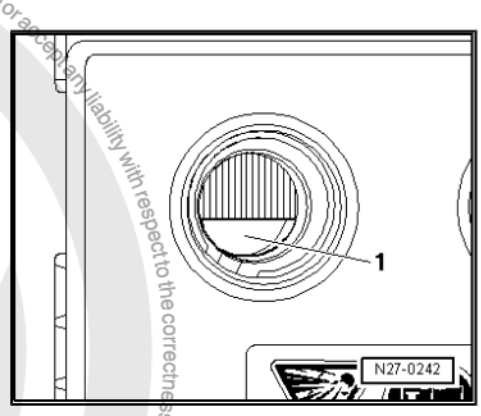
Note

The sticker with the warning notes should remain on the battery.

– Remove the removable caps from the cells.

– Check the electrolyte level in the cells of the Battery - A- .

The electrolyte level is correct when it is at the plastic tab -1-.



Note

The plastic tab corresponds to the maximum mark for the acid level.

If the electrolyte level is correct:

– Check the cell caps and the O-Rings for damage. Any damaged components should be replaced.

– Close the cells with their respective caps.

If the electrolyte level is below the plastic tab:

– Top it up with distilled water ⇒ page 12 .

2.5.2 Top it up with distilled water

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

– Turn off the ignition and all electrical equipment.

– Remove, if applicable, the protective stickers on the removal caps.

Note

The sticker with the warning notes should remain on the battery.

– Remove the removable caps from the cells.

Caution

- *Using electrolyte or any other liquid other than distilled water to top up the Battery - A- will damage it. Top the battery up with distilled water only.*
- *The Battery - A- may be damaged if the cells are over-filled. The Battery - A- should be carefully topped up in order to avoid acid spills.*

– Top up with distilled water until the level reaches the maximum mark.
– Check the cell caps and the O-Rings for damage. Any damaged components should be replaced.
– Close the cells with their respective caps.
– Check the battery charge ⇒ page 16 .

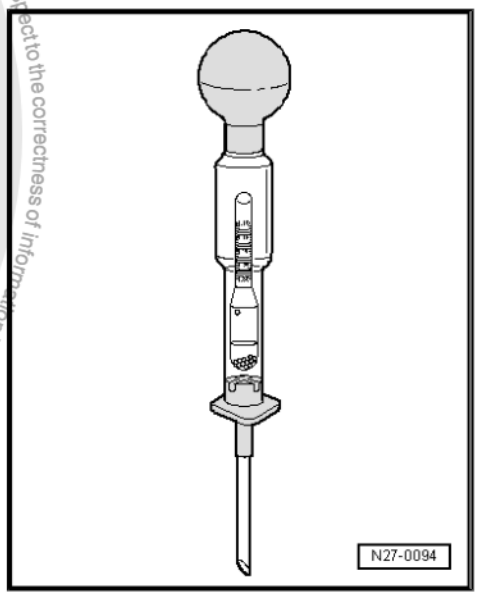
2.5.3 Verifying the density of the electrolyte

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Special tools and workshop equipment required

- Commercially available densometer



– Turn off the ignition and all electrical equipment.
– Remove, if applicable, the protective stickers on the removal caps.

Note

The sticker with the warning notes should remain on the Battery - A- .

– Remove the removable caps from the cells.
– Check the electrolyte level in the battery - A- ⇒ page 12 .

– Dip the densimeter into one of the cells and remove a large enough sample of electrolyte so as to make the buoy in the densimeter float freely.

The greater the specific density of the electrolyte, the more the buoy will emerge from the electrolyte. The value can be read from a scale on the buoy.

Electrolyte density	Condition of charge	Power
1,28 g/cm^3	100 %	12.7 V
1,21 g/cm^3	60 %	12.3 V
1,18 g/cm^3	40 %	12.1 V
1,10 g/cm^3	0 %	11.6 V

Note

Checking the electrolyte density immediately after topping the battery up with distilled water will give an incorrect measurement. Verify the density of the electrolyte only after the Battery - A- has been charged.

– Check the cell caps and the O-Rings for damage. Any damaged components should be replaced.
– Close the cells with their respective caps.

2.6 Current consumption - test

WARNING

Batteries showing a bright yellow colour in the battery window must not be tested or charged. Do not jump start the vehicle!

Risk of explosion during testing, charging or jump starting.

These batteries must be replaced.

Note

- *Ensure the correct charging mode is set on the charging device to avoid interference in the current consumption test.*
- *VAS 5095A, ⇒ "3.1 Battery charger VAS 5095A ", page 35*
- *VAS 5900, ⇒ "3.2 Battery charger VAS 5900 ", page 40*
- *VAS 5900 A, ⇒ "3.3 Battery charger VAS 5900A ", page 51*
- *VAS 5903, ⇒ "3.4 Battery charger VAS 5903 ", page 53*
- *VAS 5906, ⇒ "3.5 Battery charger VAS 5906 ", page 64*
- *VAS 5908, ⇒ "3.6 Battery charger VAS 5908 ", page 66*

To quickly confirm the battery conditions, in case of discharged batteries, a decision can be made based on the battery's current consumption during charging, establishing whether the battery must be replaced or fully recharged.

Note

During the Battery test - VAS 6161- , current consumption tests must always be performed if the test result “perform current consumption test” is shown on the display.

Current consumption tests must always be performed in

- ♦ the following results of the inspection test with Battery test - VAS 6161- :

1 - Perform current consumption test

Controlling a battery's current consumption capacity allows quickly assessing whether a partially charged or fully discharged battery ⇒ page 75 can keep working after recharging.

Preliminary test conditions:

- ♦ During battery charging, the temperature should be at least ≥ +10 °C
- ♦ The charging unit can deliver a minimum charging current of 30 A, such as in VAS 5095A, VAS 5900, VAS 5903.
- ♦ When charging with a Battery charger - VAS 5095A- , the battery's current consumption must be measured with current pliers, such as VAS 5051B/7. The battery charger - VAS 5900- and the battery charger - VAS 5903- indicate a current intake on the device. The battery charger - VAS 5900- automatically controls current consumption through a menu.

– Connect the battery to the battery charger and initiate the battery charging procedure.

– Measure the battery's charging current after five minutes.

Test result:

If current A consumption is higher than 10% of the Ah rated capacity (e.g. > 6.1 A at 61 Ah), charge the battery completely and test again.

Note

For Eos with two 6V sealed batteries, the charging current can only exceed the battery's rated capacity in amps by 5%. Example for Eos: the 50 Ah battery must have a charging current over 2.5 A after five minutes of charging.

– Check if the charging current is higher than 10% of the rated capacity after fully charging the battery (considering the exception for Eos detailed above).

– Let the battery rest for two hours and test ⇒ page 22 .

After 5 minutes of charging, if the charging current is under 10% of the rated capacity (5% in two 6-volt batteries in Eos) in Amps (i.e. < 5A for a 50-Ah battery), replace the battery. Fill out the battery test sheet in cases of warranty and giveaways.

2.7 Check the charge of the Battery - A-

⇒ “2.7.1 Battery tester with printer VAS 5097A ”, page 17

⇒ “2.7.2 Description of the battery testing device, with printer VAS 5097A ”, page 17

⇒ “2.7.3 Check the battery A charge with the battery tester with printer VAS 5097A ”, page 18

⇒ “2.7.4 Battery tester VAS 6161 ”, page 21

⇒ “2.7.5 Description of the Battery testing device VAS 6161 ”, page 21

⇒ “2.7.6 Checking the Battery A charge with the Battery tester VAS 6161 ”, page 22

⇒ “2.7.7 Testing in maintenance mode”, page 23

⇒ “2.7.8 Testing in warranty mode”, page 24

⇒ “2.7.9 Testing in technical assistance mode”, page 25

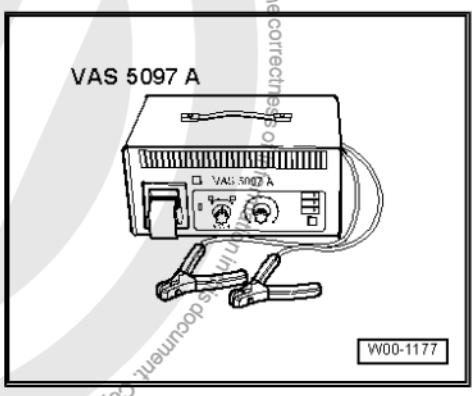
⇒ “2.7.10 Printed protocol information”, page 26

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

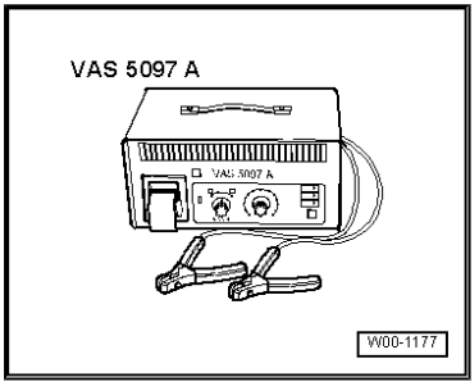
Special tools and workshop equipment required

- Battery tester with printer - VAS 5097A-



Additional information about the battery testing device, with printer - VAS 5097A- ⇒ page 17 .

2.7.1 Battery tester with printer - VAS 5097A-



Battery tester with printer - VAS 5097A-

It is not necessary to disconnect or remove the Battery - A- to use the battery tester with printer - VAS 5097A- .

The battery tester with printer - VAS 5097A- enables 12V batteries to be checked with:

- 80 - 499 A of cold test current, in compliance with the DIN norm (Deutsche Industrie Norm - German Industry Norm)[1)]
- 95 - 574 A of cold test current, in compliance with the IEC (International Engineering Consortium)
- 136 - 855 A of cold test current, in compliance with the EN/SAE (European Norm/Standard of Automotive Engineers)

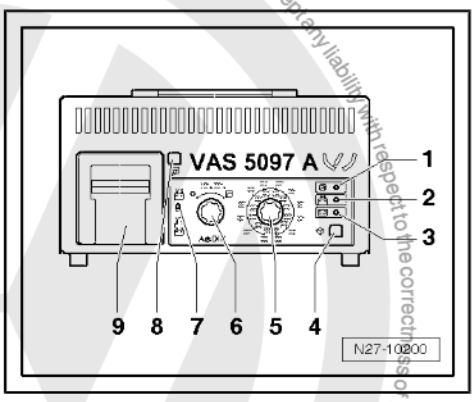
1) Batteries with a cold test current of 520 A in compliance with the DIN norm can be checked with the device adjusted to 499 A, in compliance with the DIN norm

To execute the test, the batteries are charged with a current equivalent to the starting current for a passenger vehicle. The Battery - A- is evaluated with this charge and the reading is obtained from the printer.

Note

- *Consult the ⇒ instructions manual of the battery testing device, with printer - VAS 5097A- or the ⇒ quick guide for the battery testing device, with printer - VAS 5097A- label on the device or the table: cold test current* *⇒ page 19*
- *Follow the manufacturer operating instructions for the Battery - A- .*

2.7.2 Description of the battery testing device, with printer - VAS 5097A-



Battery tester with printer - VAS 5097A-

1 - Green LED “device operational”

2 - Red LED, “device on with poles on”

3 - Red LED, “battery not compatible with the test”, battery needs replacing

4 - Activation key

5 - Cold test current selection switch

6 - Functions and ON/OFF switch

7 - Connection point selection switch (testing device connected to the battery/the external verification point in the engine compartment)

8 - Button to advance paper

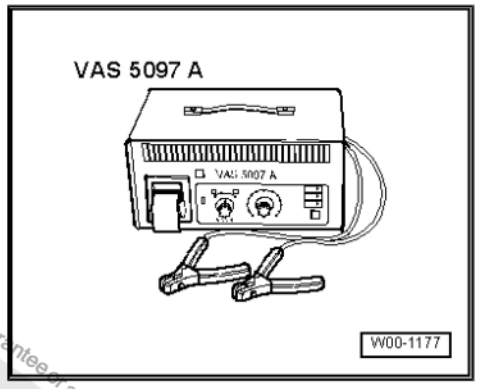
9 - Printer

2.7.3 Check the battery - A- charge with the battery tester with printer - VAS 5097A-

> **WARNING**
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

Special tools and workshop equipment required

- Battery tester with printer - VAS 5097A-



Check the battery - A- charge with the battery tester with printer - VAS 5097A- :

Note

The Battery -A- must be at a minimum temperature of 10°C.

- Turn off the ignition and all electrical equipment.
- Check the resting voltage of the battery - A- ⇒ page 33 .
- Adjust the cold test current of the battery - A- in Amperes (A), in compliance with the DIN norm.

If the value indicated on the Battery - A- is not in compliance with the DIN norm, but is in compliance with the IEC or the EN/SAE norm, the indicated value needs to be converted with the help of the table ⇒ page 19 , or the table on the device.

- Select the cold test current with the cold test current selector switch ⇒ page 17 -5-.
- Select the 80 - 379 A and/or 380 - 499 A measurement range with the functions and ON/OFF switch ⇒ page 17 -6-.
- Connect the red terminal “+” of the testing device to the positive pole.
- Connect the black terminal “-” of the testing device to the negative pole.

Note

Check that the testing terminals are properly in contact

– Select the connection point of the testing terminals with the switch ⇒ page 17 -7-.

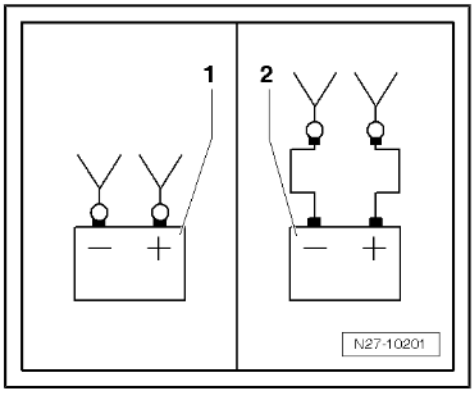
1 - Right connection to the Battery - A- .

2 - Connection to the external testing point in the engine compartment.

– Check that the cold testing current indicated on the Battery - - corresponds to the value set on the testing device for batteries.

– Press the ⇒ page 17 -4-activation button.

The green LED lights up ⇒ page 17 -1-. The testing program begins automatically. The test result is obtained from the printer ⇒ page 17 -9-.



– Turn off the device ⇒ page 17 -6-.

– Remove the test terminals.

Note

- *The test takes approximately 20 seconds.*
- *Test results are obtained from the printer.*
- *Carry out the test once only. If the test is repeated, the results will be incorrect.*
- *The battery tester with printer - VAS 5097A- needs approximately 30 min. to cool and perform the next measurement.*

Table: cold test current

Cold test current in A			
EN/SAE	IEC	⇒	DIN
136 - 17	95 - 124	⇒	80 - 104
178 - 219	125 - 154	⇒	105 - 129
220 - 261	155 - 184	⇒	130 - 154
262 - 303	185 - 214	⇒	155 - 179
304 - 345	215 - 244	⇒	180 - 204
346 - 387	245 - 274	⇒	204 - 229
388 - 429	275 - 304	⇒	230 - 254
430 - 471	305 - 334	⇒	255 - 279
472 - 513	335 - 364	⇒	280 - 304
514 - 555	365 - 394	⇒	305 -329
556 - 597	395 - 424	⇒	330 - 354
598 - 639	425 - 454	⇒	355 - 379
640 - 657	455 - 464	⇒	380 - 389
658 - 675	465 - 474	⇒	390 - 399
676 - 693	475 - 484	⇒	400 - 409
694 - 711	485 - 494	⇒	410 - 419
712 - 729	495 - 504	⇒	420 - 429
730 - 747	505 - 514	⇒	430 - 439
748 - 765	515 - 524	⇒	440 - 449
766 - 783	525 - 534	⇒	450 - 459
784 - 801	535 - 544	⇒	460 - 469
802 - 819	545 - 554	⇒	470 - 479
820 - 837	555 - 564	⇒	480 - 489

Cold test current in A			
EN/SAE	IEC	⇒	DIN
838 - 855	565 - 574	⇒	490 - 499[2)]

2) Batteries with a cold test current of 520 A in compliance with the DIN norm can be checked with the device adjusted to 499 A, in compliance with the DIN norm

Interpretation of the test results:

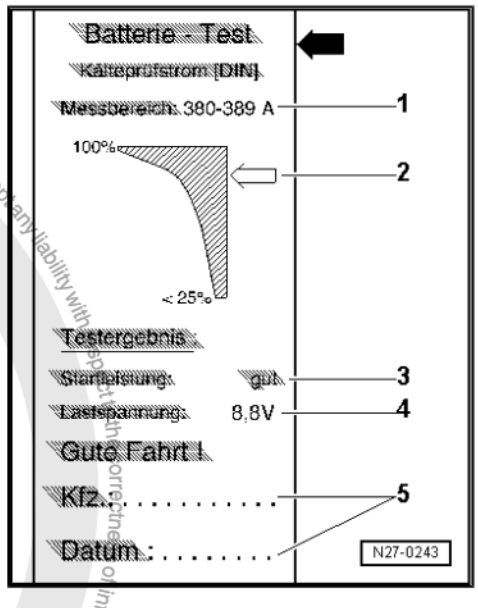
1 - Measurement range selected in the device.

2 - Diagram, the -arrow- indicates the condition of the Battery - A- .

3 - Test result.

4 - Power in the battery during the charge test.

5 - Vehicle data and date. These should be filled in by the professional responsible for the test.



Due to the strong charge to the battery during the test (a high current flows into it), battery power will diminish.

- If the Battery - A- is in order, the voltage will come down only to the minimum voltage.
- If the Battery - A- is damaged or has a low charge, then the battery voltage will quickly drop below the minimum voltage.
- After testing, this low voltage will remain for some time, and will rise slowly.
- Carry out the test once only. If the test is repeated, the results will be incorrect.
- In order to test another battery - A- , it is necessary to wait until the battery tester with printer - VAS 5097A- cools down, for approximately 30 min., in order to obtain a correct measuring result.

Note

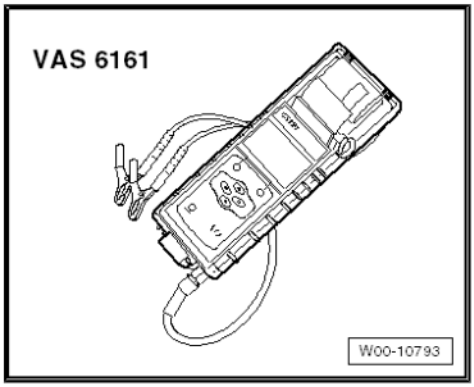
The printing of the test result is necessary for the replacement procedure, according to the guarantee.

Analysis of the test results:

Battery test device printout	Measures to be taken
Very good starting power	Battery - A- in order
Good starting power	Battery - A- in order
Insufficient starting power	Charge the Battery - A- [3)]
Weak starting power	Charge the Battery - A- [3)]
Very poor starting power	Charge the Battery - A- [3)]
Unsuitable for tests	Charge the Battery - A- [3)]

3) After recharging the battery, carry out another test of the battery charge. If after recharging the battery the following indications "insufficient starting power, poor starting power, very poor starting power or unsuitable for tests"appear, then the battery needs replacing.

2.7.4 Battery tester - VAS 6161-



WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

It is not necessary to turn off or remove the Battery - A- to use the Battery tester - VAS 6161- .

Several battery types are registered in the Battery testing device - VAS 6161- .

Data can be memorized in an SD card.

The Battery testing device - VAS 6161- is updated using an SD card.

Note

For further information, consult the ⇒ Instruction manual of the Battery testing device - VAS 6161- .

2.7.5 Description of the Battery testing device - VAS 6161-

1 - Integrated printer

2 - Lever to open the paper compartment

3 - Paper output

4 - LCD display with main menu

5 - Control panel with the “on/off” Power button

6 - Testing cable connector

7 - SD card slot

8 - Infrared temperature sensor

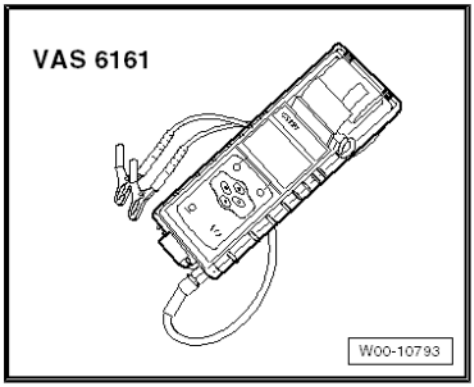
9 - Data transmitter

2.7.6 Checking the Battery - A- charge with the Battery tester - VAS 6161-

> ⚠ WARNING
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

Special tools and workshop equipment required

- Battery testing device - VAS 6161-



– Turn off the ignition and all electrical equipment.
– Turn on the Battery testing device - VAS 6161- .
– Connect the red terminal “+” of the Battery testing device - VAS 6161- to the positive pole.
– Connect the black terminal “-” of the Battery testing device - VAS 6161- to the negative pole.

Note

Check that the testing terminals are properly in contact

– Select one of the following functions.
- Maintenance mode: specifically for VW dealership inventory and showroom vehicles ⇒ page 23 .
- Warranty mode: for batteries during the warranty period ⇒ page 24 .
- Assistance mode: for batteries beyond the warranty period ⇒ page 25 .

Note

- *The verification results may be printed;*
- *No time interval is required before initiating a new test.*

2.7.7 Testing in maintenance mode

Note

Before performing the test, it is necessary to charge the Battery - A- , using the Battery charger - VAS 5900- ⇒ page 41 or the Battery charger - VAS 5900A- ⇒ page 51 .

– After charging the Battery - A- , wait for 2 hours.
– Turn on the Battery testing device - VAS 6161- .
– Select “maintenance test” in the menu.
– Type in the VIN code (vehicle identification number).
– Select “Battery terminal” or “Starter terminal”, according to the location of the terminals.
– Select the Battery - A- model.

– Measure the temperature. Keep the Battery tester - VAS 6161- temperature sensor 5 cm away from one of the sides or the upper part of the Battery - A- until temperature stabilizes.
– Initiate the test.

Maintenance test result analysis:

Test result	Action
GOOD BATTERY	Resume battery use.
RECHARGE	Recharge the battery ⇒ page 35 and test it once again.
FAULTY / REPL.	Identify and replace the faulty battery.

Note

Should, after recharging and the new test of the Battery - A- , the result be any other than that of a good battery, replace the Battery - A-

2.7.8 Testing in warranty mode

Note

Before performing the test, it is necessary to charge the Battery - A- , using the Battery charger - VAS 5900- ⇒ page 41 or the Battery charger - VAS 5900A- ⇒ page 51 .

– After charging the Battery - A- , wait for 2 hours.
– Turn on the Battery testing device - VAS 6161- .
– Select “WARRANTY TEST” from the menu.
– Select the location of the Battery - A- “Outside the vehicle” or “In the Vehicle”.
– Select “Battery terminal” or “External terminal”, according to the location of the terminals.
– Select the type of the Battery - A- “Normal”.
– Select the Battery - A- model.
– Measure the temperature. Keep the Battery tester - VAS 6161- temperature sensor 5 cm away from one of the sides or the upper part of the Battery - A- until temperature stabilizes.
– Initiate the test.

Warranty test result analysis:

Test result	Action
GOOD BATTERY	Resume battery use.
GOOD - RECHARGE	Recharge the battery ⇒ page 35 and test it once again.
TEST CHARGE ACCEPT-ANCE	Perform the charge acceptance test ⇒ page 27
FAULTY BATTERY	Replace the battery.

Test result	Action
EXTERNAL TERMINAL	Connect the cable directly into the battery terminal instead of the external terminal.

Note

- *In case the result is charge acceptance test, and the Battery - A- was tested outside the vehicle, charge the Battery - A- ⇒ page 35 and test it once again; in case of any result other than "GOOD BATTERY", replace the Battery - A- .*
- *Should, after recharging and the new test of the Battery - A- , the result be any other than that of a "GOOD BATTERY", replace the Battery - A-*

2.7.9 Testing in technical assistance mode

Note

Before performing the test, it is necessary to charge the Battery - A- , using the Battery charger - VAS 5900- ⇒ page 41 or the Battery charger - VAS 5900A- ⇒ page 51 .

– After charging the Battery - A- , wait for 2 hours.

– Turn on the Battery testing device - VAS 6161- .

– Select "assistance test" in the menu.

– Select "Battery terminal" or "External terminal", according to the location of the terminals.

– Select the type of the Battery - A- "Normal".

– Select the "CCA", "JIS", "DIN", "SAE", "IEC" or "EN" standard (as indicated in the battery label).

– Select the Battery - A- model.

– Measure the temperature. Keep the Battery tester - VAS 6161- temperature sensor 5 cm away from one of the sides or the upper part of the Battery - A- until temperature stabilizes.

– Initiate the test.

Assistance test result analysis:

Test result	Action
GOOD BATTERY	Resume battery use.
GOOD - RECHARGE	Recharge the battery ⇒ page 35 and test it once again.
CHARGE + TEST	Perform the charge acceptance test ⇒ page 27 , charge and test the battery once again
FAULTY BATTERY	Check connections regarding cables and battery poles and retest the battery. If the diagnosis is repeated, replace the battery.
BAD CELL	Replace the battery.

Test result	Action
EXTERNAL TERMINAL	Connect the cable directly into the battery terminal instead of the starter terminal.

Note

Should, after recharging and the new test of the Battery - A- , the result be any other than that of a "GOOD BATTERY", replace the Battery - A-

2.7.10 Printed protocol information

1 - Test type
- ❑ Maintenance, warranty or assistance mode

2 - Test result

Check respective actions:
- ❑ Maintenance mode ⇒ page 24 .
- ❑ Warranty mode ⇒ page 24 .
- ❑ Assistance mode ⇒ page 25 .

3 - Measured voltage

4 - Battery cold start value measured

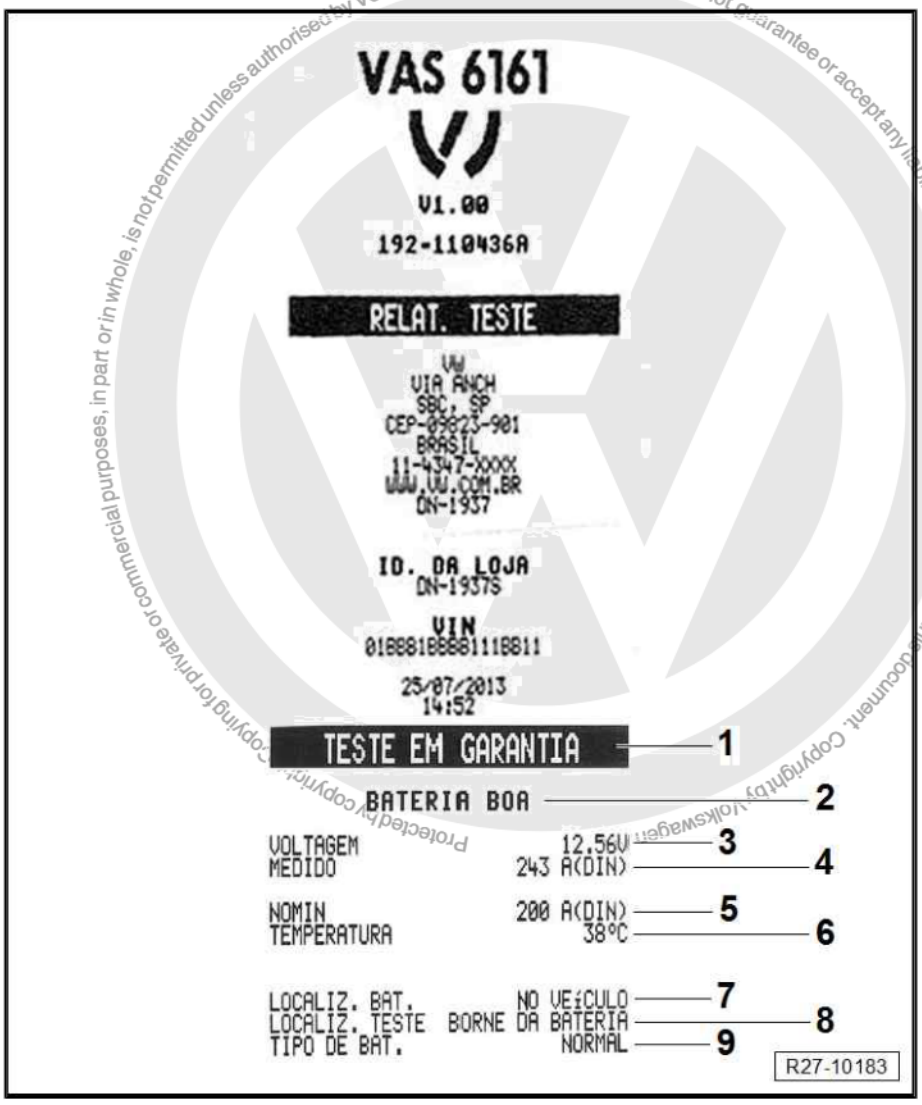
5 - Battery cold start rated value
- ❑ Selected in the device

6 - Battery temperature

7 - Battery location
- ❑ In the vehicle or outside the vehicle

8 - Test location
- ❑ Battery or starter terminal

9 - Battery type



2.8 Charge acceptance test

⇒ "2.8.1 Charge acceptance test with the VAS 6161 ", page 27

⇒ "2.8.2 Charge acceptance test with the VAS 5097A ", page 27

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Note

- *Ensure that the regulated charge mode is correct, in order not to compromise the charge acceptance test.*
- *Battery charger - VAS 5095A- ⇒ page 36 .*
- *Battery charger - VAS 5900- ⇒ page 41 .*
- *Battery charger - VAS 5900A- ⇒ page 51 .*
- *Battery charger - VAS 5903- ⇒ page 54 .*
- *Battery charger - VAS 5906- ⇒ page 65 .*

2.8.1 Charge acceptance test with the -VAS 6161-

The charge acceptance test must be performed in case of the following battery check results, under the warranty or technical support modes with the Battery test - VAS 6161- :

1 - Test charge acceptance

2 - Charge+Test

Depending on the Battery tester - VAS 6161- results, other verification steps or activities to clearly establish the condition of the Battery - A- can be carried out.

Execute the following tasks:

– Connect the Battery - A- to the battery charger and have it fully charged.

– After a 2 hour resting time run the Battery - A- checking test again in the following modes:

1 - Warranty mode testing. ⇒ page 24

2 - Technical support testing. ⇒ page 25

2.8.2 Charge acceptance test with the -VAS 5097A-

In case of flat batteries, to obtain a rapid response on the charge state of the battery, it is possible to obtain a quick answer whether the battery - A- should be replaced or recharged during the intake of current by the battery - A- .

The current consumption test must be carried out whenever the verification test result with the Battery testing device, with printer - VAS 5097A- presents one of the following results:

1 - Sufficient kick-start power

2 - Unsatisfactory kick-start power

3 - Very unsatisfactory kick-start power

4 - Not compatible with the test - Charge the Battery - A- and repeat the test

5 - In the event that the device does not turn on (no LED, no printout)

Depending on the Battery tester results ⇒ page 20 , Battery test device with printer - VAS 5097A- other verification steps or activities to clearly establish the condition of the Battery - A- can be carried out.

Verification of the current intake capacity of a Battery - A- during the charging process enables a very quick assessment whether it is possible to reuse the Battery - A- or not, notwithstanding whether the battery is uncharged or charged.

Checking conditions:

- During battery - A- charging, the temperature should be at least ≥ 10 °C
- The charging device must debit at least 30 A of the charging current, as is the case of the battery charger - VAS 5095A- , battery charger - VAS 5900- , battery charger - VAS 5903- .
- When charging the Battery - A- with the battery charger - VAS 5095A- , the current intake of the battery must be measured with the Amp Clamp - VAS 5051B/7- .
- The battery charger - VAS 5900- and the battery charger - VAS 5903- indicate a current intake on the device.

Execute the following tasks:

– Connect the Battery - A- to the battery charger and initiate the charging process.

– After five minutes, measure the charge current of the Battery - A- .

Verification result:

Five minutes after initiating the charging procedure, the charge current should be 10% above the nominal capacity.

Example:

For a 60 Ah Battery - A- the charge current should be higher than 6 A, 5 minutes after charging has begun.

– Fully charge the Battery - A- when the charge current is higher than 10% of the nominal capacity.

– After a resting time of two hours, check the Battery - A- ⇒ page 18 charge.

If the charge current is less than 10% of the nominal capacity (in amperes) five minutes after charging has begun, (in other words, for a battery with 60 Ah < 6A), replace the Battery - A- .

2.9 Check the resting current of the battery

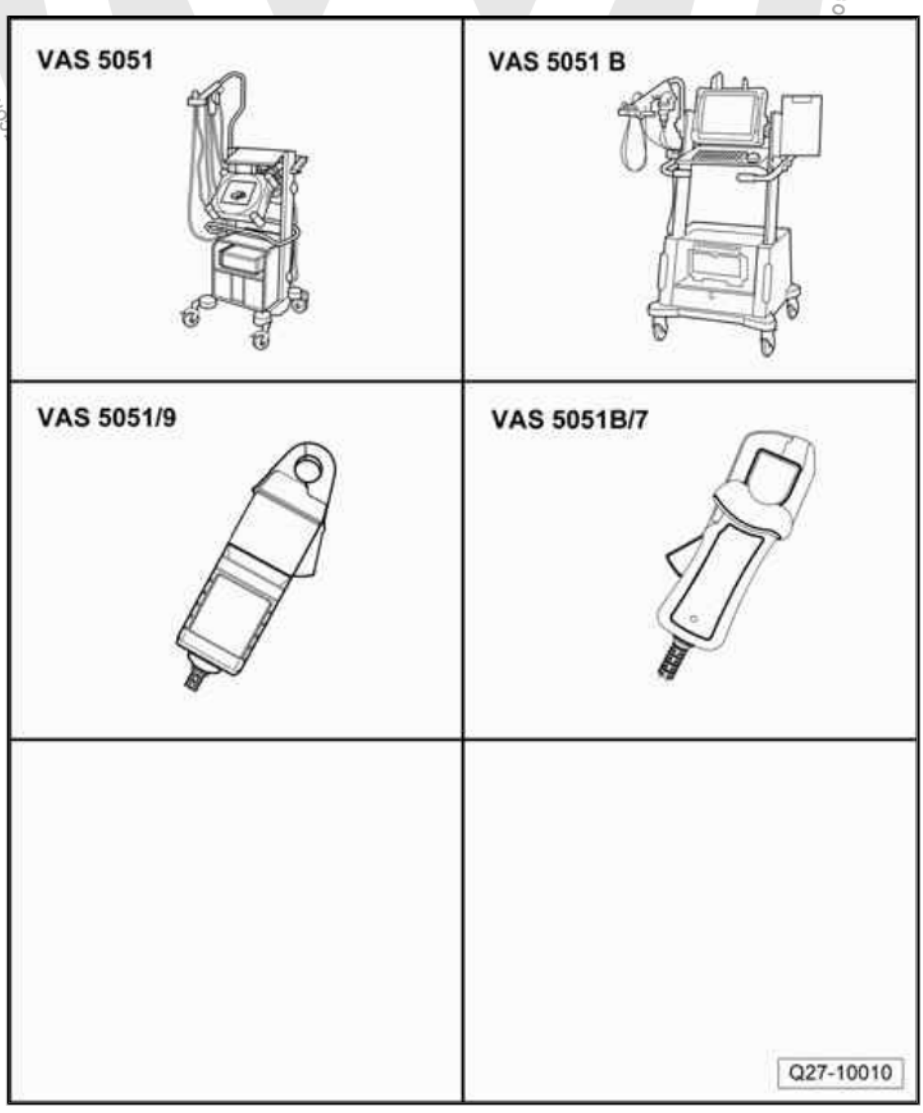
WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Note

Other available test equipment and tools may also be used. Refer to the ⇒ Special Tools and Workshop Equipment Catalogue .

Special tools and workshop equipment required



- Vehicle diagnostic, testing and information system - VAS 5051A-
- Vehicle diagnostic, testing and information system - VAS 5051B-
- Amp clamp 50A - VAS 5051/9-
- Amp clamp - VAS 5051B/7-

Note

Measuring the resting current determines the existence of current loss from the Battery - A- in vehicles that are turned off.

Checking conditions:

- Await a minimum of 2 hours. During this time, do not open the doors or the luggage compartment so that the units remain at rest.
- Attention should also be given to the bonnet contact switch / anti-theft alarm and vermin repellent switch - F120- , for the alarm unit not to leave the resting status.

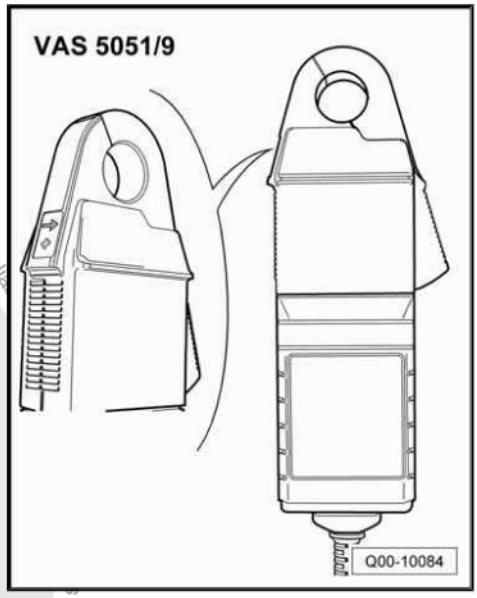
Checking:

- Turn off the ignition and all electrical equipment.
- Remove the ignition key.
- Await a minimum of 2 hours.

Note

- *Prior to performing the test, calibrate the 50A amp clamp - VAS 5051/9- or later equipment.*
- *There is no need to connect the diagnostic cable to the 16-pin diagnostic connector - T16- .*

– Place the 50A amp clamp - VAS 5051/9- or later equipment onto the negative cable of the battery according to the arrow in the direction of the body.



Verification result:

– Check the resting current for the Battery - A- on the table:

BATTERIES		
Capacity (Ah)	For vehicles (► 06/22/2008)	For vehicles (06/23/2008►)
	Maximum current loss (mA)	Maximum current loss (mA)
36	13.5	10.5
40	15	11.7
44	16.5	12.8
48	18	14
51	19.1	14.9
54	20.3	15.8
59	22.1	17.2
60	22.5	17.5
61	22.9	17.8
63	23.6	18.4
68	25.5	19.8
69	25.9	20.1
70	26.3	20.4
72	27	21
80	30	23.3
85	31.9	24.8
92	34.5	26.8
95	35.6	27.7
110	41.3	32.1

Note

If the amount of current indicated in the measurement is greater than indicated on the table, there may be an electric system failure.

2.10 Check the final battery charge

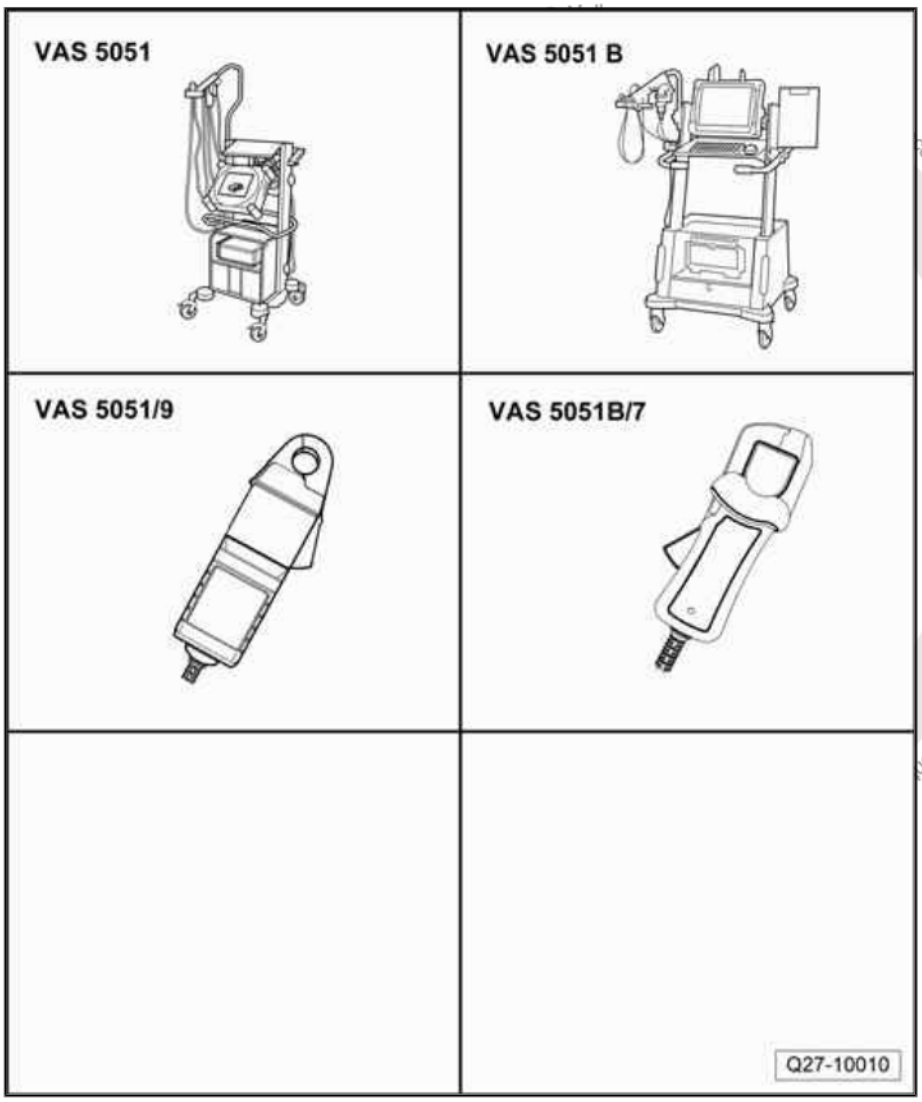
WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Note

Other available test equipment and tools may also be used. Refer to the ⇒ Special Tools and Workshop Equipment Catalogue .

Special tools and workshop equipment required



- Vehicle diagnostic, testing and information system - VAS 5051A-
- Vehicle diagnostic, testing and information system - VAS 5051B-
- Amp clamp 50A - VAS 5051/9-
- Amp Clamp - VAS 5051B/7-

Checking:

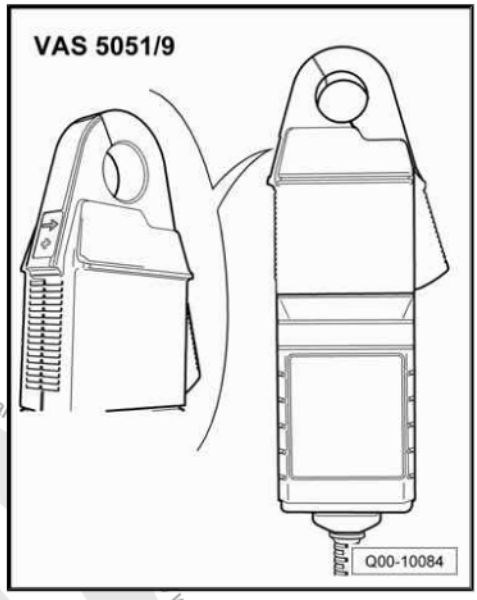
Note

- *Prior to performing the test, calibrate the 50A amp clamp - VAS 5051/9- or later equipment.*
- *There is no need to connect the diagnostic cable to the 16-pin diagnostic connector - T16- .*

– Place the 50A amp clamp - VAS 5051/9- or later equipment onto the negative cable of the battery according to the arrow in the direction of the body.
– Turn the vehicle on and await engine rotation to stabilize.

Verification result:

– The current value should be positive, demonstrating that the vehicle is being charged by the alternator.



Note

When turning on electrical consumers, the current should, at no time, be negative, which would demonstrate an failure in the charging of the battery by the alternator.

2.11 Checking the resting voltage of batteries (unused or stored vehicles)

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Special tools and workshop equipment required

♦ Portable multimeter or EQ 7318 or EQ 7321 - VAG 1526C-

Note

♦ *The Battery - - should not have been charged or drained inside the two hours that precede the measuring. Charging or draining procedures executed in this period will result in incorrect measurement.*
♦ *The purpose of measuring the quiescent voltage is to determine whether it is necessary to charge the Battery - A- later on in an unused or stored vehicle.*

Checking conditions:

– Disconnect the terminal from the negative pole of the Battery - A- .

– Wait at least 2 hours. During this period, the Battery - A- is not to be charged or drained.
– Measure the quiescent voltage of the Battery - A- with the Portable multimeter or EQ 7318 or EQ 7321 - VAG 1526C- .

Quiescent voltage	Condition of charge	State of the battery
11.6 V	0 %	Drained, no charge. Totally drained ⇒ page 75 .

Measurement	Procedure
Quiescent voltage ≥ 12.5 V	Quiescent voltage in order, check the charge of the battery ⇒ page 16 .
Quiescent voltage < 12.5 V	Charge the battery - A- ⇒ page 35 .

If the Battery - A- was charged, proceed as follows basis the outcome of the reading:

– Wait at least 2 hours. During this period, the Battery - A- is not to be charged or drained.
– Measure the quiescent voltage of the Battery - A- with the Portable multimeter or EQ 7318 or EQ 7321 - VAG 1526C- .

Note

If, after charging the quiescent voltage of the Battery - A- is < (12.5 V), Battery - A- must be replaced.

3 Battery -A- - charging

⇒ “3.1 Battery charger VAS 5095A ”, page 35

⇒ “3.2 Battery charger VAS 5900 ”, page 40

⇒ “3.3 Battery charger VAS 5900A ”, page 51

⇒ “3.4 Battery charger VAS 5903 ”, page 53

⇒ “3.5 Battery charger VAS 5906 ”, page 64

⇒ “3.6 Battery charger VAS 5908 ”, page 66

⇒ “3.7 Completely flat batteries”, page 75

⇒ “3.8 Battery (Delphi) - charging procedure”, page 76

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

In order to avoid damage to the Battery - - or to the vehicle, pay attention to the notes on Battery - A- ⇒ page 2 types.

3.1 Battery charger - VAS 5095A-

⇒ “3.1.1 Description of the Battery charger VAS 5095A ”, page 36

⇒ “3.1.2 Charging the Battery A with the Battery charger VAS 5095A ”, page 36

⇒ “3.1.3 Charging a heavily drained Battery A with the Battery charger VAS 5095A ”, page 37

⇒ “3.1.4 Auxiliary operations with the Battery charger VAS 5095A ”, page 38

⇒ “3.1.5 Trickle charge with the Battery charger VAS 5095A ”, page 39

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

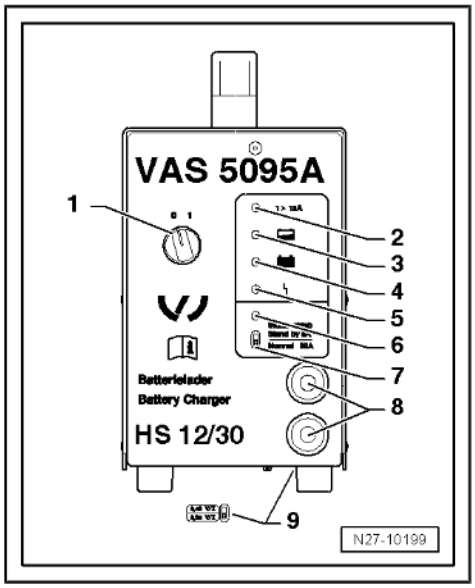
In this chapter, the basic functions of the Battery charger - VAS 5095A- are described. For further information, consult the ⇒ Instruction manual of the Battery charger - VAS 5095A- .

Note

- *This device does not enable a reading of the effective charge current. The charge current should be measured with a current measuring clamp.*
- *Consult the ⇒ Instruction manual Battery charger - VAS 5095A- .*

3.1.1 Description of the Battery charger - VAS 5095A-

The Battery charger - VAS 5095A- is suitable for charging all 12 V batteries.



1 - ON/OFF switch (0 = OFF)

2 - Indication of charge current (I > 12A)

3 - Indication of the charge current; Battery - A- partially charged > 90%

4 - Charge held; the green light turns on when the Battery - - is charged

5 - Indication of fault

6 - Indication of auxiliary operation

7 - Operation selection/normal operation switch

8 - Charging cable, red charging terminal “+”, black charging terminal “-”

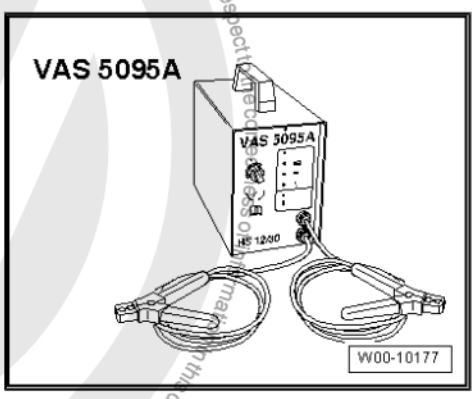
9 - Type of battery selection switch (at the base of the charger)

3.1.2 Charging the Battery - A- with the Battery charger - VAS 5095A-

> **WARNING**
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

Special tools and workshop equipment required

- Battery charger - VAS 5095A-



> **Caution**
>
> *When charging, always set the Battery - A- type at 2.4 V/C (Volt/cell). This indication is applicable to all batteries.*

Note

- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

Execute the following tasks:

– Turn off the ignition and all electrical equipment.

– Check the Battery - A- type setting on the selection switch for the type of Battery - A- ⇒ page 36 -9-. This should be set to 2.4 V/C (Volt/cell).

– Connect the red charging terminal "+" of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal "-" of the charger to the negative pole of the Battery - A- .

– Turn on the charger ⇒ page 36 -1-.

The indications of the charge current ⇒ page 36 -2- and -3- are indicated by a LED (yellow). The Battery - A- will be partially charged (approx. 90 %) when the LED (yellow) -3- lights up.

If the LED (green) ⇒ page 36 -4- also lights up, the charger has commuted to a trickle charge. The Battery - A- is charged.

– Turn off the charger ⇒ page 36 -1-.

– Remove the charging terminals from the poles of the Battery - A- .

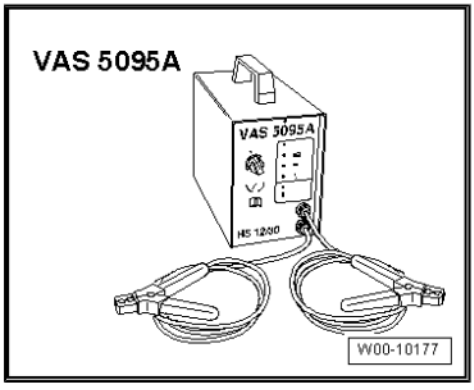
3.1.3 Charging a heavily drained Battery - A- with the Battery charger - VAS 5095A-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Special tools and workshop equipment required

- Battery charger - VAS 5095A-



The charger automatically recognizes completely drained batteries and begins the charging procedure with a lower charge current in order not to damage them. The charging current is automatically adjusted to the charge condition of the Battery - A- .

Note

- *Pay attention to the notes in chapter entitled "Completely drained batteries"* ⇒ page 75 .
- *The minimum voltage of the Battery - A- should be 0.6V*

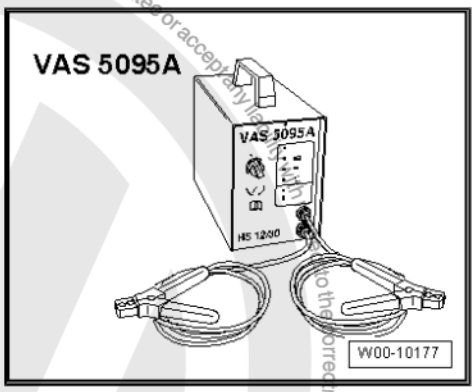
– Charge the battery - A- ⇒ page 36 .

3.1.4 Auxiliary operations with the Battery charger - VAS 5095A-

> WARNING
>
> *Risk of injuries! Pay attention to the warning notes and security norms* ⇒ page 3 .

Special tools and workshop equipment required

- Battery charger - VAS 5095A-



General information:

During auxiliary operation, the Battery charger - VAS 5095A- takes over the functions of the dysfunctional Battery - A- in the vehicle, whilst the latter is being replaced. The on-board voltage remains unaltered. Electrical components in the vehicle (for example, electric windows) can be used normally.

Further information can be obtained in the ⇒ VAS 5095A Instruction manual

Support function is suitable for the following situations:

- Supporting the functioning of on-board systems without an installed Battery - A-
- maintenance of voltage in the event of the Battery - A- replacement
- Testing of aggregates without Battery - A-

> Caution
>
> - *When charging, always set the Battery - A- type at 2.4 V/C (Volt/cell). This indication is applicable to all batteries.*
> - *The charge terminals of the Battery charger - VAS 5095A- must not detach themselves from the poles of the Battery - A- during battery replacement.*

– Turn off the ignition and all electrical equipment.
– Set the auxiliary operations/normal operations switch ⇒ page 36 -7- to “auxiliary operation”.
– Connect the red charging terminal “+” of the charger to the positive pole of the vehicle.
– Connect the black charging terminal “-” of the charger to the negative pole of the vehicle.
– Check the Battery - A- type setting on the selection switch for the type of Battery - A- ⇒ page 36 -9-. This should be set to 2.4 V/C (Volt/cell).
– Turn on the charger ⇒ page 36 -1-.

The yellow LEDs ⇒ page 36 -3- and -6- light up.

Note

- *A minimum charge of 0.6 A is necessary (e.g. tail lights). Otherwise, auxiliary operation cannot be activated.*
- *During auxiliary operation, the intensity of the current is restricted to 5A.*

– Turn on the tail lights of the vehicle.
– Replace the Battery - A- .
– Turn off the charger ⇒ page 36 -1-.
– Remove the charging terminals from the poles of the Battery - A- .
– Reset the auxiliary operations/normal operations switch ⇒ page 36 -7- to “normal operation”.

3.1.5 Trickle charge with the Battery charger - VAS 5095A-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

When trickle charging, the Battery charger - VAS 5095A- provides a safe charge and keeps the Battery - A- charged.

– The procedure is identical to that of charging the Battery - A- ⇒ page 36 .

Note

- *If, during trickle charging, the Battery - A- is drained by an electrical consumer, the Battery charger - VAS 5095A- automatically compensates it with the corresponding charge.*
- *The trickle charge has no time limit to be executed.*
- *The Battery - A- is always operational.*

3.2 Battery charger - VAS 5900-

⇒ “3.2.1 Description of the Battery charger VAS 5900 ”, page 40

⇒ “3.2.2 Charging the Battery A with the Battery charger VAS 5900 ”, page 41

⇒ “3.2.3 Servicing charge with the Battery charger VAS 5900 ”, page 44

⇒ “3.2.4 Charging a completely drained battery with the Battery charger VAS 5900 ”, page 46

⇒ “3.2.5 Auxiliary operations with the Battery charger VAS 5900 ”, page 49

⇒ “3.2.6 Trickle charge operational mode with the Battery charger VAS 5900 ”, page 50

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

In this chapter, the basic functions of the Battery charger - VAS 5900- are described. For further information, consult the ⇒ Instruction manual of the Battery charger - VAS 5900- .

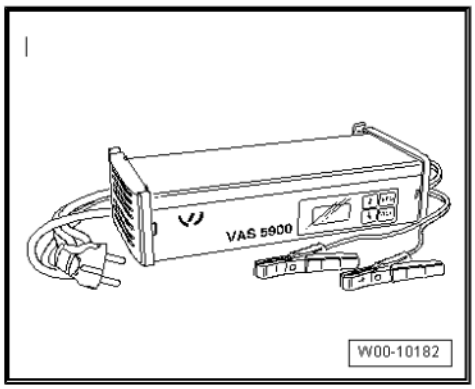
Note

- *This device does not enable a reading of the effective charge current.*
- *Consult the ⇒ Instruction manual Battery charger - VAS 5900- .*

3.2.1 Description of the Battery charger - VAS 5900-

The Battery charger - VAS 5900- is suitable for charging all 12 V batteries.

Battery charger - VAS 5900-



Panoramic view of the control panel:

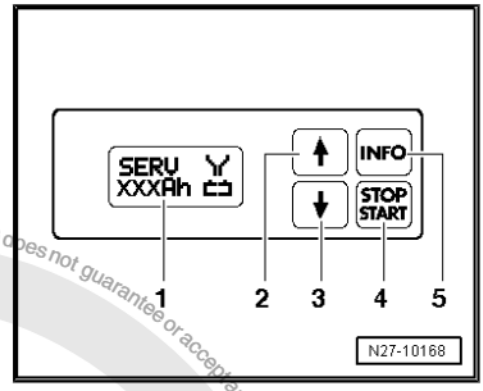
1 - Display

2 - Adjustment button “Up” [↑]

3 - Adjustment button “Down” [↓]

4 - “ON/OFF” [START/STOP] button

5 - “Information” [INFO] button



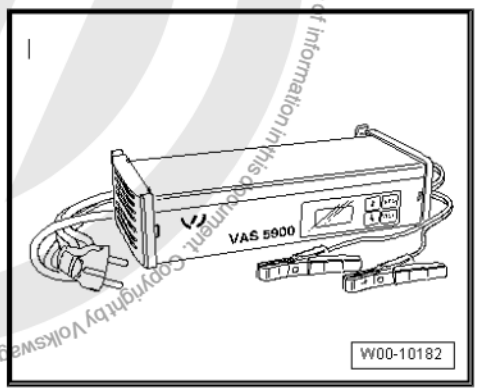
3.2.2 Charging the Battery - A- with the Battery charger - VAS 5900-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Special tools and workshop equipment required

- Battery charger - VAS 5900-



Note

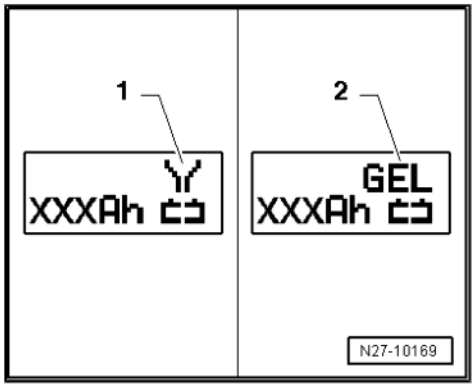
- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

Execute the following tasks:

– Turn off the ignition and all electrical equipment.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 41 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.



On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.

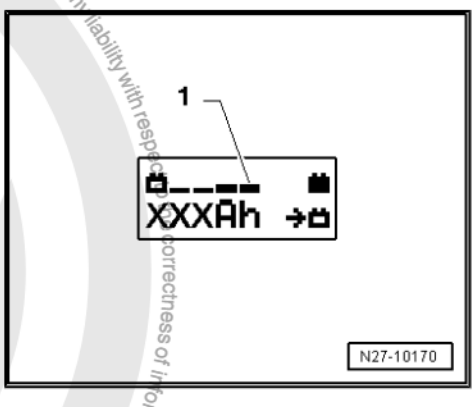
– Set the Battery - A- capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

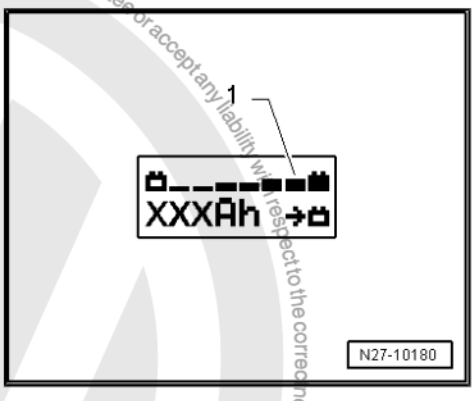
The charger recognizes the nominal voltage of the Battery - A- connected (6 V, 12 V or 24 V) and starts charging automatically.

Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-.



When 100% charged, all the bars will appear on the display -1-.

The Battery - A- is ready for use.



Note

- *In the "normal charging" operational mode, all electrical components in the vehicle can be activated. However, the charging process will take longer.*
- *According to the type of Battery - A- , the charger commutes to trickle charge after a period of 1 - 7 hours. To achieve a 100% charge, the Battery - A- should remain connected to the charger for this entire period.*

After the Battery - A- has been charged:

– Press the START/STOP button.

– Disconnect the charger's black charging terminal "-" from the negative pole of the Battery - A- .

– Disconnect the charger's red charging terminal "+" from the positive pole of the Battery - A- .

– Disconnect the charger from its power source.

Troubleshooting:

1 - The Battery - A- voltage indicated does not correspond to the nominal voltage:

– Keep the "Up" ↑ or "Down" ↓ button pressed until charging begins.

2 - The Battery - A- 's indicated voltage does not correspond to the nominal voltage - charging has already begun:

– Press the START/STOP button twice.

– Keep the "Up" ↑ or "Down" ↓ button pressed until a new charging starts.

3 - The charger does not recognize any Battery - A- if the voltage is less than 2 V:

The information on the display remains unaltered:

The Battery - A- type and the amperes/hour (Ah) setting are displayed.

Finalizing Battery - A- charging:

– Press the START/STOP button.

– Disconnect the charger's black charging terminal "-" from the negative pole of the Battery - A- .

– Disconnect the charger's red charging terminal "+" from the positive pole of the Battery - A- .

– Disconnect the charger from its power source.

3.2.3 Servicing charge with the Battery charger - VAS 5900-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

The "service charging" procedure must not be executed when the Battery - A- is installed in the vehicle, because the current peaks can damage the on-board electronic system.

If, despite all, the "service charging" operation is carried out with the battery still in the vehicle, the Battery - A- should be disconnected from the on-board system.

Caution

During charging, always set the type of operation corresponding to the Battery - A- ⇒ Instruction manual of the Battery charger - VAS 5900-!

The "servicing charge" operation is only permitted for:

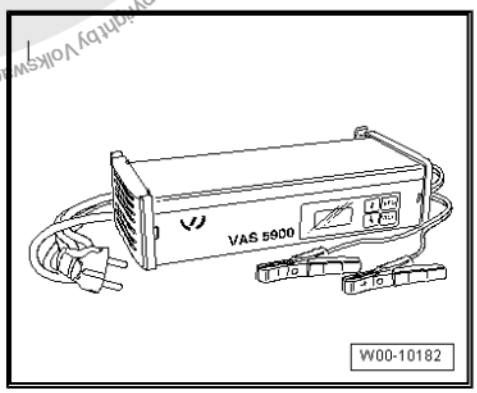
- *Standard batteries that have been topped up with distilled water.*
- *Gel/AGM batteries.*

Do no use the "servicing charge" operation in maintenance-free standard batteries ⇒ page 2 .

The "service charging (SERV)" function type is only used when damage to a Battery - A- is suspected (for example, sulfation). In this case the Battery - A- is charged to the maximum density of the electrolyte and the plates are reactivated (elimination of the sulphate layer).

Special tools and workshop equipment required

- Battery charger - VAS 5900-



Note

- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

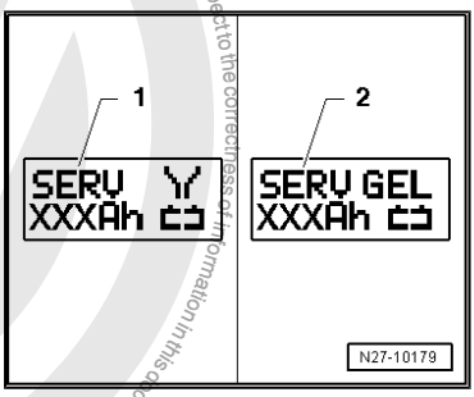
– Turn off the ignition, all the electrical devices, and remove the key from ignition.

– Disconnect the Battery - A- .

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 41 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.

On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.



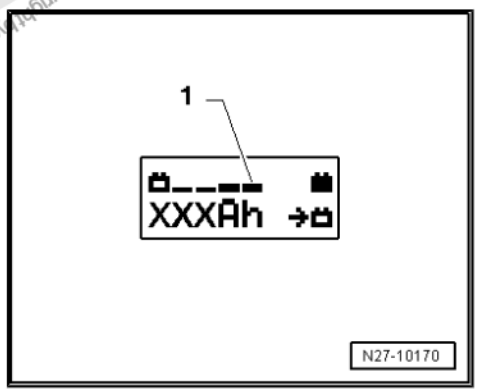
– Set the battery capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

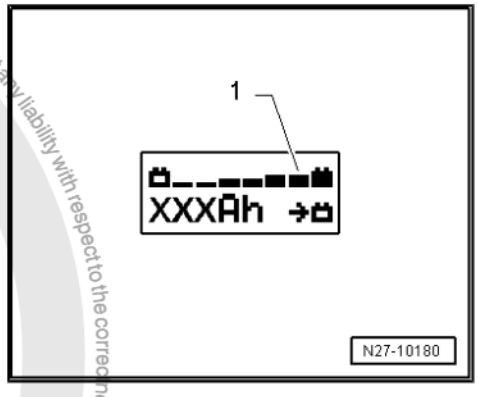
– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

The charger recognizes the nominal voltage of the Battery - A- connected (6 V, 12 V or 24 V) and starts charging automatically.

Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-. The Battery - A- is ready for use.



When 100% charged, all the bars will appear on the display -1-.



Note

The success of the "service charge" depends on the level of sulphate in the Battery - A- .

Troubleshooting:

1 - The Battery - A- voltage indicated does not correspond to the nominal voltage:

– Keep the "Up" ↑ or "Down" ↓ button pressed until charging begins.

2 - The Battery - A- 's indicated voltage does not correspond to the nominal voltage - charging has already begun:

– Press the START/STOP button twice.

– Keep the "Up" ↑ or "Down" ↓ button pressed until a new charging starts.

3 - The charger does not recognize any Battery - A- if the voltage is less than 2 V:

The information on the display remains unaltered:

The Battery - A- type and the amperes/hour (Ah) setting are displayed.

Finalizing Battery - A- charging:

– Press the START/STOP button.

– Disconnect the charger's black charging terminal "-" from the negative pole of the Battery - A- .

– Disconnect the charger's red charging terminal "+" from the positive pole of the Battery - A- .

– Disconnect the charger from its power source.

3.2.4 Charging a completely drained battery with the Battery charger - VAS 5900-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

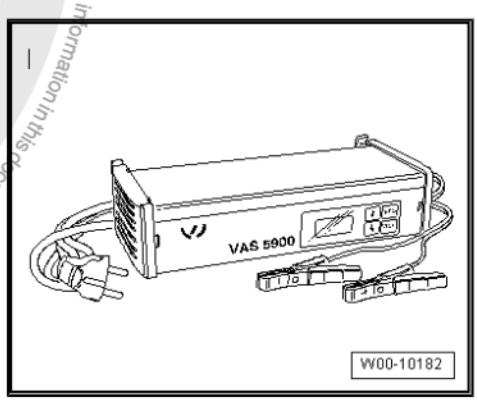
- *The protective device for the proper connect of the charge terminals is not activated in the "charging of completely drained batteries/auxiliary operation" mode. Connect the poles of the charging terminals correctly to the Battery - A- pole terminals.*
- *During charging, always set the type of operation corresponding to the Battery - A- ⇒ Instruction manual of the Battery charger - VAS 5900- .*
- *A very drained Battery - A- is not recognized by the charger ⇒ page 75 .*
- *Do not press the START/STOP button if the connection of the charge terminals is incorrect! It could damage the charger.*

Note

Batteries with voltages less than 2 V are not automatically recognized by the Battery charger - VAS 5900- .

Special tools and workshop equipment required

- Battery charger - VAS 5900-



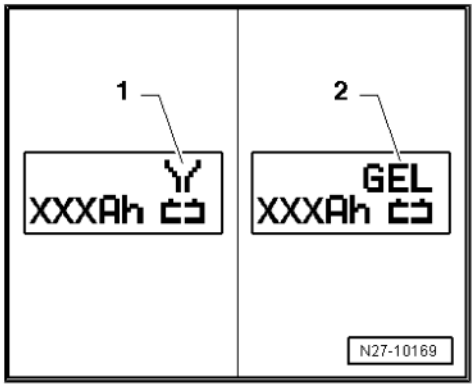
Note

- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical equipment.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 41 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.



On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.

– Set the Battery - A- capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.
– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .
– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .
– Press the START/STOP button for approx. 5 seconds. The menu “charging of completely drained batteries/auxiliary operation” will be activated.
– Press the “Up” ↑ or “Down” ↓bottom, in order to set the voltage corresponding to the Battery - A- (6 V, 12 V or 24 V).

Note

If no button is pressed for 5 seconds, the charger will return to the main menu (select type of operation).

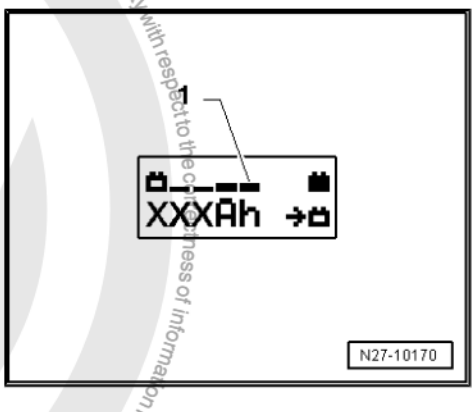
– Confirm the Battery - - selected voltage with the START/STOP button.

Next the correct connection of the charging terminal poles is requested.

– Check that the poles of the charging terminals are correctly connected.
– Confirm the correct connection of the charging terminal poles with the START/STOP.button.

The charger will start charging the very drained Battery - A- .

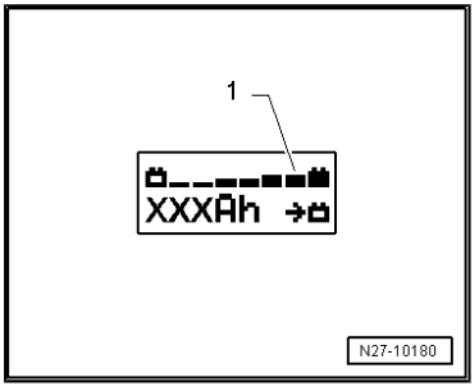
Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-. The Battery - A- is ready for use.



When 100% charged, all the bars will appear on the display -1-.

After the Battery - A- has been charged:

- Press the START/STOP button.
- Disconnect the charger's black charging terminal “-” from the negative pole of the Battery - A- .
- Disconnect the charger's red charging terminal “+” from the positive pole of the Battery - A- .
- Disconnect the charger from its power source.



3.2.5 Auxiliary operations with the Battery charger - VAS 5900-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

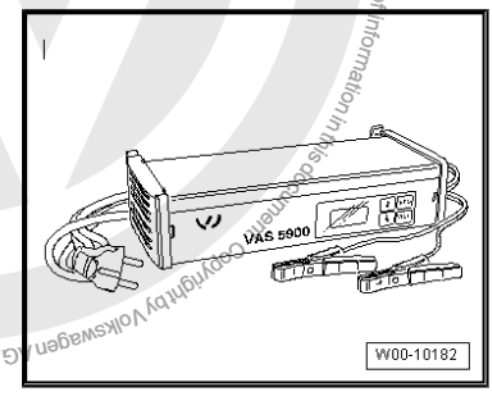
- *The protective device for the proper connect of the charge terminals is not activated in the “charging of completely drained batteries/auxiliary operation” mode. Connect the poles of the charging terminals to the terminals of the poles of the Battery correctly.*
- *During charging, always set the type of operation corresponding to the battery ⇒ Instruction manual of the Battery charger - VAS 5900- !*
- *Do not press the START/STOP button if the connection of the charge terminals is incorrect! It could damage the charger.*

General information:

During auxiliary operation, the Battery charger - VAS 5900- takes over the functions of the dysfunctional Battery - A- in the vehicle, whilst the latter is being replaced. The on-board voltage remains unaltered. Electrical components in the vehicle (for example, electric windows) can be used normally.

Special tools and workshop equipment required

- Battery charger - VAS 5900-



- Turn off the ignition and all electrical equipment.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 41 -1-.
– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .
– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .
– Press the START/STOP button. 5 seconds. The menu “charging of completely drained batteries/auxiliary operation” will be activated.
– Press the “Up” ↑ or “Down” ↓button, in order to set the voltage corresponding to the Battery - A- (6V, 12V or 24V).

Note

If no button is pressed for 5 seconds, the charger will return to the main menu (select type of operation).

– Confirm the Battery - - selected voltage with the START/STOP button.

Next the correct connection of the charging terminal poles is requested.

– Check that the poles of the charging terminals are correctly connected.
– Confirm the correct connection of the charging terminal poles with the START/STOP.button.

The charger initiates auxiliary operation.

– Replace the Battery - A- .
– Press START/STOP to conclude auxiliary operation.
– Disconnect the black charging terminal “-” of the charger to the negative pole of the vehicle.
– Disconnect the red charging terminal “+” of the charger to the positive pole of the vehicle.
– Disconnect the charger from its power source.

3.2.6 Trickle charge operational mode with the Battery charger - VAS 5900-

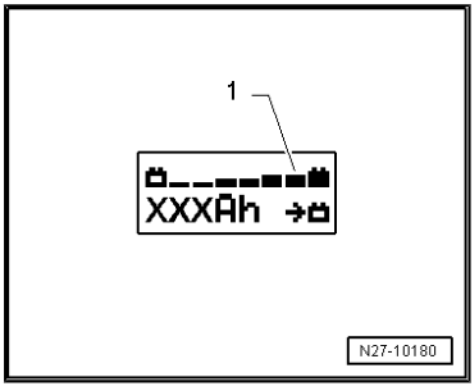
WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

If the Battery - A- is fully charged, the Battery charger - VAS 5900- will initiate trickle charging.

– The procedure is identical to that of charging the Battery - A- ⇒ page 41 .

When 100% charged, all the bars will appear on the display -1-.



Note

- *If the Battery - A- is drained by an electrical component during the stabilizer's operation, the Battery charger - VAS 5900- will automatically compensate this with the respective recharge.*
- *Stabilizer operation has no time limit.*
- *The Battery - A- is always operational.*
- *Follow Battery - A- manufacturer's operation instructions.*

3.3 Battery charger - VAS 5900A-

⇒ "3.3.1 Battery charger VAS 5900A ", page 51

⇒ "3.3.2 Battery charger VAS 5900A operation modes", page 52

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

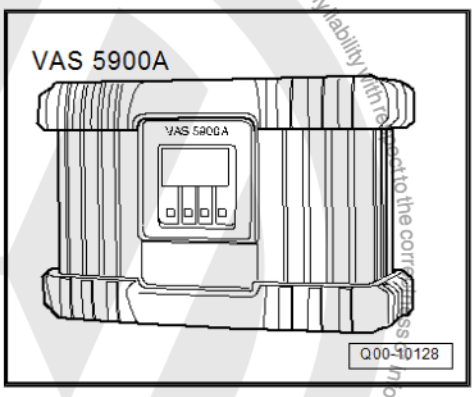
Note

Refer to the ⇒ Instruction manual of Battery charger - VAS 5900A- .

3.3.1 Battery charger - VAS 5900A-

The Battery charger - VAS 5900A- is suitable for charging all 6/ 12/ 24 V batteries.

Battery charger - VAS 5900A-



Panoramic view of the control panel:

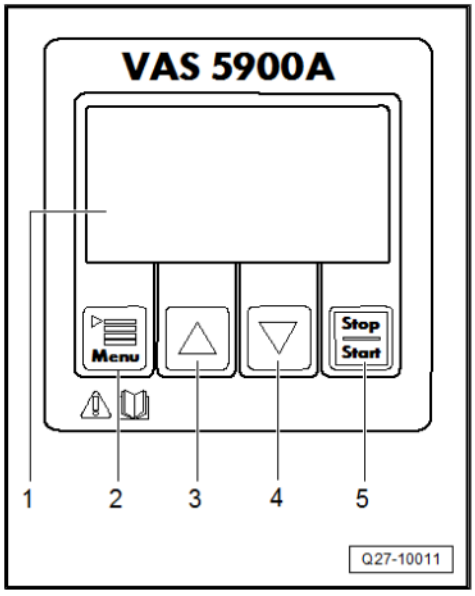
1 - Display

2 - “Adjustment selection” Menu button

3 - Adjustment button “Up” ▲

4 - Adjustment button “Down” ▼

5 - “On/Off” STOP/START button



3.3.2 Battery charger - VAS 5900A- operation modes

Note

- *The Battery - A- must be at a minimum temperature of 10°C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical equipment.

– Connect the charger to a power source.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

The charger recognizes the nominal voltage of the connected Battery - A- (6, 12 or 24 V).

Charging operation mode:

- Charging or conservation charging in assembled or disassembled condition;
- Charging with vehicle electrical consumers on.

Support operation mode:

- Exclusively to relieve the Battery - A- during vehicle diagnostic or software updating.

WARNING

The support operation mode is not suitable for full charging of the Battery - A- .

"Refresh" operation mode:

- Used to charge the Battery - A- if there is supposedly a long-time discharge.

Power supply operation mode:

- In this mode, charging cables are directly connected to battery cables or external points of the vehicle. This ensures power supply to the on-board electronics during repair services with Battery - A- "removed".

Note

As in this case only the vehicle battery cables are connected to the charger, the battery voltage recognition function is not available.

3.4 Battery charger - VAS 5903-

⇒ "3.4.1 Description of the Battery charger VAS 5903 ", page 54

⇒ "3.4.2 Charging the Battery A with the Battery charger VAS 5903 ", page 54

⇒ "3.4.3 Servicing charge with the Battery charger VAS 5903 ", page 56

⇒ "3.4.4 Charging a heavily drained Battery A with Battery charger VAS 5903 ", page 59

⇒ "3.4.5 Auxiliary operations with the Battery charger VAS 5903 ", page 62

⇒ "3.4.6 Trickle charge operational mode with the Battery charger VAS 5903 ", page 63

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

In this chapter, the basic functions of the Battery charger - VAS 5903- are described. For further information, consult the ⇒ Instruction manual of the Battery charger - VAS 5903- .

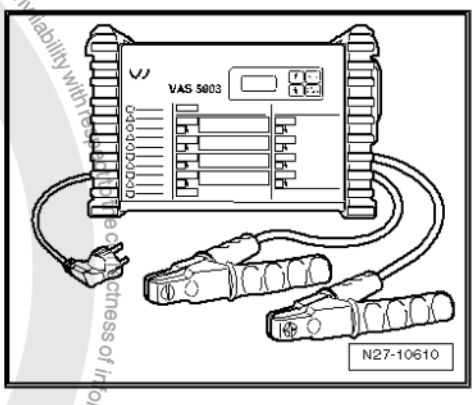
Note

Follow the ⇒ Instruction manual of Battery charger - VAS 5903- .

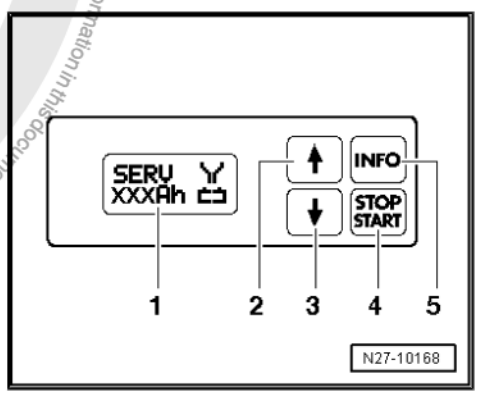
3.4.1 Description of the Battery charger - VAS 5903-

The Battery charger - VAS 5903- is suitable for charging all 12 V batteries.

Battery charger - VAS 5903-



Panoramic view of the control panel



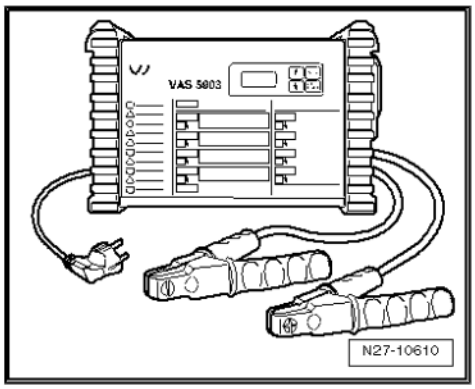
1 - Display
2 - Adjustment button “Up” [↑]
3 - Adjustment button “Down” [↓]
4 - “ON/OFF” START/STOP button
5 - “Information” INFO button

3.4.2 Charging the Battery - A- with the Battery charger - VAS 5903-

> **WARNING**
>
> *Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .*

Special tools and workshop equipment required

- Battery charger - VAS 5903-



Note

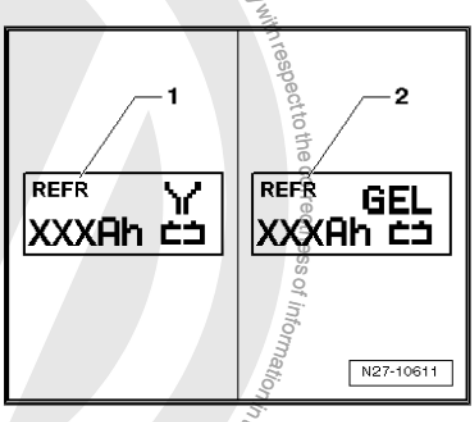
- *The Battery - A- must be at a minimum temperature of 10°C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical equipment.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 54 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.

On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.



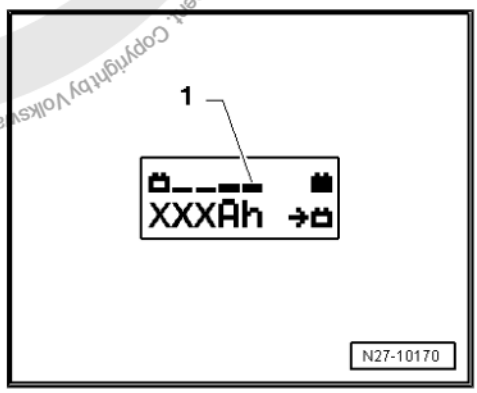
– Set the Battery - A- capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

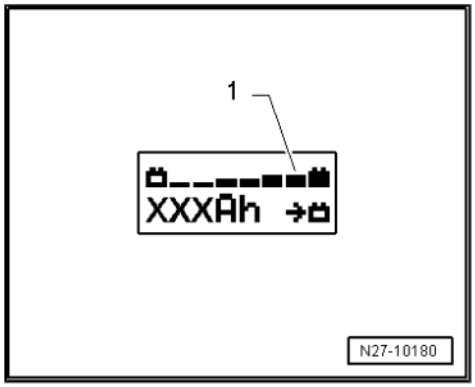
The charger recognizes the nominal voltage of the Battery - A- connected (6 V, 12 V or 24 V) and starts charging automatically.

Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-.



When 100% charged, all the bars will appear on the display -1-.

The Battery - A- is ready for use.



Note

- *In the "normal charging" operational mode, all electrical components in the vehicle can be activated. However, the charging process will take longer.*
- *According to the type of Battery - A- , the charger commutes to trickle charge after a period of 1 to 7 hours. To achieve a 100% charge, the Battery - A- should remain connected to the charger for this entire period.*

Troubleshooting:

1 - The Battery - A- voltage indicated does not correspond to the nominal voltage:

– Keep the "Up" [↑] or "Down" [↓] button pressed until charging begins.

2 - The Battery - A- 's indicated voltage does not correspond to the nominal voltage - charging has already begun:

– Press the [START/STOP] button twice.

– Keep the "Up" [↑] or "Down" [↓] button pressed until a new charging starts.

3 - The charger does not recognize any Battery - A- if the voltage is less than 2 V:

The information on the display remains unaltered:

The Battery - A- type and the amperes/hour (Ah) setting are displayed.

Finalizing Battery - A- charging:

– Press the [START/STOP] button.

– Disconnect the charger's black charging terminal "-" from the negative pole of the Battery - A- .

– Disconnect the charger's red charging terminal "+" from the positive pole of the Battery - A- .

– Disconnect the charger from its power source.

3.4.3 Servicing charge with the Battery charger - VAS 5903-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Caution

The "service charging" procedure must not be executed when the Battery - A- is installed in the vehicle, because the current peaks can damage the on-board electronic system.

If, despite all, the "service charging" operation is carried out with the battery still in the vehicle, the Battery - A- should be disconnected from the on-board system.

Caution

During charging, always set the type of operation corresponding to the Battery - A- ⇒ Instruction manual of the Battery charger - VAS 5903- !

The "servicing charge" operation is only permitted for:

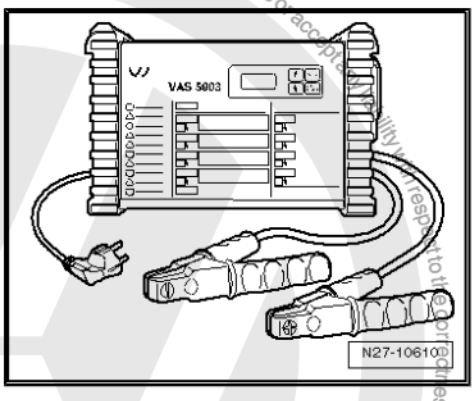
- *Standard batteries that have been topped up with distilled water.*
- *Gel/AGM batteries.*

Do no use the "servicing charge" operation in maintenance-free standard batteries.

The "service charging (SERV)" function type is only used when damage to a Battery - A- is suspected (for example, sulfation). In this case the Battery - A- is charged to the maximum density of the electrolyte and the plates are reactivated (elimination of the sulphate layer).

Special tools and workshop equipment required

- Battery charger - VAS 5903-



Note

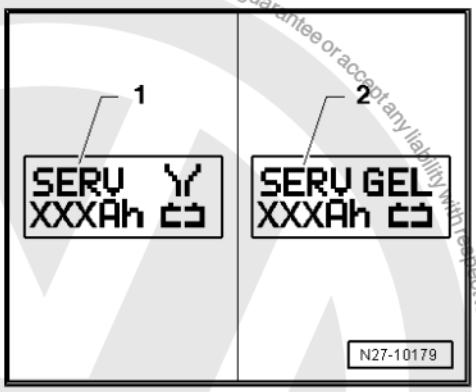
- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical components.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 54 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.

On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.



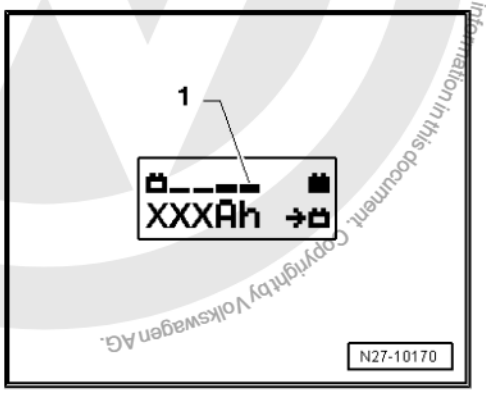
– Set the Battery - A- capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

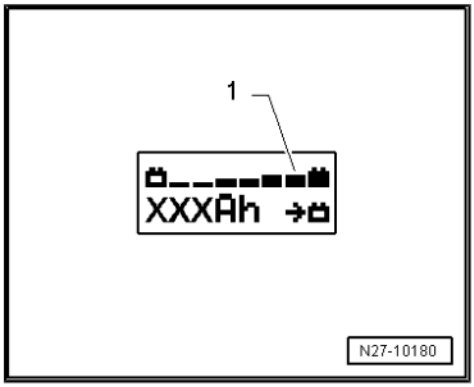
– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

The charger recognizes the nominal voltage of the Battery - A- connected (6 V, 12 V or 24 V) and starts charging automatically.

Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-. The Battery - A- is ready for use.



When 100% charged, all the bars will appear on the display -1-.



Note

The success of the "service charge" depends on the level of sulphate in the Battery - A- .

Troubleshooting:

1 - The Battery - A- voltage indicated does not correspond to the nominal voltage:

– Keep the "Up" ↑ or "Down" ↓ button pressed until charging begins.

2 - The Battery - A- 's indicated voltage does not correspond to the nominal voltage - charging has already begun:

– Press the START/STOP button twice.

– Keep the "Up" ↑ or "Down" ↓ button pressed until a new charging starts.

3 - The charger does not recognize any Battery - A- if the voltage is less than 2 V:

The information on the display remains unaltered:

The Battery - A- type and the amperes/hour (Ah) setting are displayed.

Finalizing Battery - A- charging:

– Press the START/STOP button.

– Disconnect the charger's black charging terminal "-" from the negative pole of the Battery - A- .

– Disconnect the charger's red charging terminal "+" from the positive pole of the Battery - A- .

– Disconnect the charger from its power source.

– Connect the Battery - A- .

3.4.4 Charging a heavily drained Battery - A- with Battery charger - VAS 5903-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

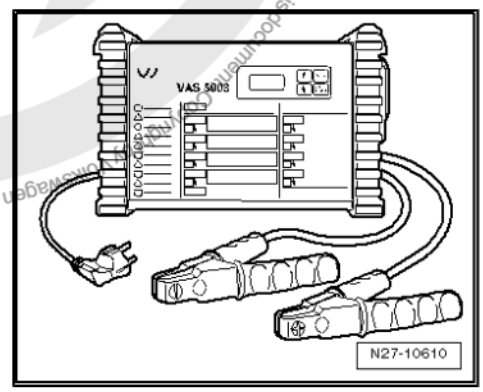
Caution

- *The protective device for the proper connect of the charge terminals is not activated in the "charging of completely drained batteries/auxiliary operation" mode. Connect the poles of the charging terminals correctly to the Battery - A- pole terminals.*
- *During charging, always set the type of operation corresponding to the Battery - A- ⇒ operating instructions of the Battery charger - VAS 5903- .*
- *A very drained Battery - A- is not recognized by the charger ⇒ page 75 .*
- *Do not press the START/STOP button if the connection of the charge terminals is incorrect! It could damage the charger.*

Batteries with voltages less than 2 V are not automatically recognized by the Battery charger - VAS 5903- .

Special tools and workshop equipment required

- Battery charger - VAS 5903-



Note

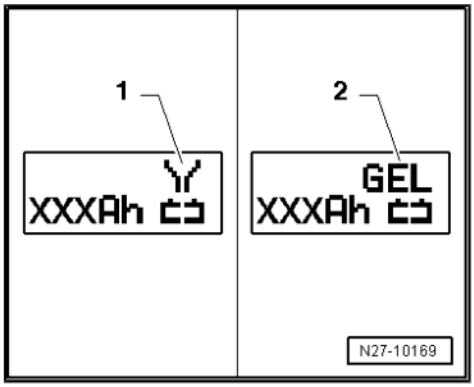
- *The Battery - A- should always be at a minimum temperature of 10 °C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical equipment.

– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 54 -1-.

– Set the type of operation corresponding to the Battery - A- using the INFO button.

On the display symbol -1- meaning “normal charging of standard batteries” or symbol -2- meaning “normal charging of Gel/AGM batteries” will appear.



– Set the Battery - A- capacity (Ah) with the “Up” ↑ or “Down” ↓ adjustment buttons.
– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .
– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .
– Press the START/STOP button for approx. 5 seconds. The menu “charging of completely drained batteries/auxiliary operation” will be activated.
– Press the “Up” ↑ or “Down” ↓ bottom, in order to set the voltage corresponding to the Battery - A- (6 V, 12 V or 24 V).

Note

If no button is pressed for 5 seconds, the charger will return to the main menu (select type of operation).

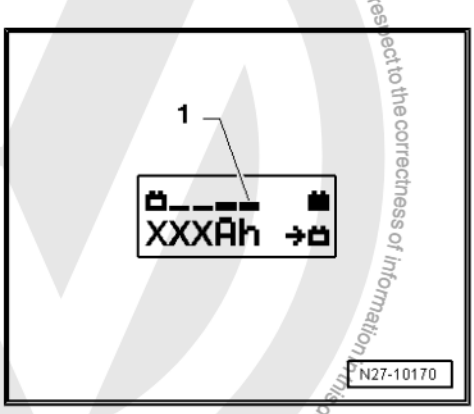
– Confirm the Battery - - selected voltage with the START/STOP button.

Next the correct connection of the charging terminal poles is requested.

– Check that the poles of the charging terminals are correctly connected.
– Confirm the correct connection of the charging terminal poles with the START/STOP button.

The charger will start charging the very drained Battery - A- .

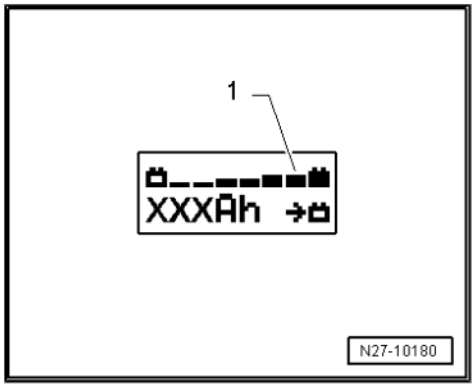
Once charged to about 80 - 85%, the charger begins “final charging”. A fourth bar appears on the display -1-. The Battery - A- is ready for use.



When 100% charged, all the bars will appear on the display -1-.

After the Battery - A- has been charged:

– Press the START/STOP button.
– Disconnect the charger's black charging terminal “-” from the negative pole of the Battery - A- .
– Disconnect the charger's red charging terminal “+” from the positive pole of the Battery - A- .
– Disconnect the charger from its power source.



3.4.5 Auxiliary operations with the Battery charger - VAS 5903-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Supporting function supplies power to the on-board systems when the Battery - A- is disconnected or removed from the vehicle.

Additional information can be obtained in the ⇒ Instruction manual of the Battery charger - VAS 5903- .

Support function is suitable for the following situations:

- Supporting the functioning of on-board systems without an installed Battery - A-
- Maintenance of voltage in the event of the Battery - A- replacement
- Testing of aggregates without Battery - A-

– Turn off the ignition and all electrical equipment.

Caution

- *The protective device for the proper connect of the charge terminals is not activated in the “charging of completely drained batteries/auxiliary operation” mode. Connect the poles of the charging terminals correctly to the Battery - A- pole terminals.*
- *During charging, always set the type of operation corresponding to the battery ⇒ Instruction manual of the Battery charger - VAS 5903- !*
- *Do not press the START/STOP button if the connection of the charge terminals is incorrect! It could damage the charger.*

– Remove the Battery - A- .
– Connect the charger to a power source. The last mode of operation selected will appear on the display ⇒ page 54 -1-.
– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal "-" of the charger to the negative pole of the Battery - A- .
– Press the START/STOP button. 5 seconds. The menu "charging of completely drained batteries/auxiliary operation" will be activated.
– Press the "Up" ↑ or "Down" ↓ button, in order to set the voltage corresponding to the Battery - A- (6V, 12V or 24V).

Note

If no button is pressed for 5 seconds, the charger will return to the main menu (select type of operation).

– Confirm the Battery - - selected voltage with the START/STOP button.

Next the correct connection of the charging terminal poles is requested.

– Check that the poles of the charging terminals are correctly connected.
– Confirm the correct connection of the charging terminal poles with the START/STOP button.

The charger initiates auxiliary operation.

– Replace the Battery - A- .
– Press START/STOP to conclude auxiliary operation.
– Disconnect the black charging terminal "-" of the charger to the negative pole of the vehicle.
– Disconnect the red charging terminal "+" of the charger to the positive pole of the vehicle.
– Disconnect the charger from its power source.

3.4.6 Trickle charge operational mode with the Battery charger - VAS 5903-

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

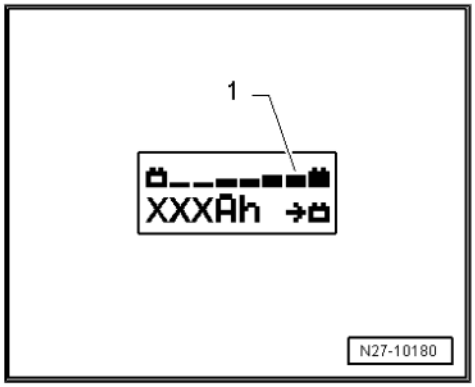
Note

- *If the Battery - A- is drained by an electrical consumer during the stabilizer's operation, the Battery charger - VAS 5903- will automatically compensate this with the respective recharge.*
- *The "trickle charge" operational mode does not have a time limit.*
- *The Battery - A- is always operational.*
- *Pay attention to notices from the Battery - A- manufacturer regarding maintenance work.*

If the Battery - A- is fully charged, the Battery charger - VAS 5903- will initiate trickle charging.

– The procedure is identical to that of charging the Battery - A- ⇒ page 54 .

When 100% charged, all the bars will appear on the display -1-.



3.5 Battery charger - VAS 5906-

⇒ "3.5.1 Description of the Battery charger VAS 5906 ", page 64

⇒ "3.5.2 Operation mode of the Battery charger VAS 5906 ", page 65

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Note

Follow the ⇒ Instruction manual of Battery charger - VAS 5906- .

- Description of the Battery charger - VAS 5906- ⇒ page 64 .
- Operation mode of the Battery charger - VAS 5906- ⇒ page 65 .

3.5.1 Description of the Battery charger - VAS 5906-

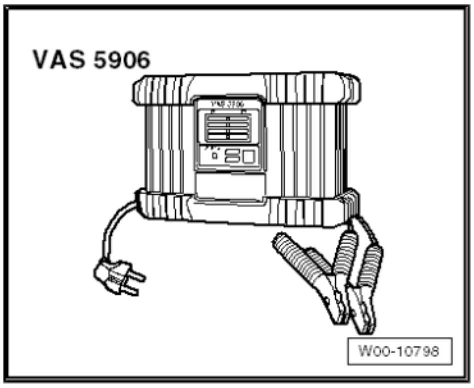
The Battery charger - VAS 5906- was especially designed to support the vehicle on board network voltage regarding exposure.

The charger has a characteristic automatic charging curve for 3 - 300 Ah batteries.

The maximum charging voltage is 14.4 V; this voltage is not exceeded while charging. All electrical consumers are supported for charging with currents up to 30 A.

After completely charging the Battery - A- the Battery charger - VAS 5906- automatically activates the maintenance (trickle) charging mode.

For additional information, refer to the ⇒ Instruction manual of the Battery charger - VAS 5906- . .



Panoramic view of the control panel:

1 - 25% charge status indicator

2 - 50% charge status indicator

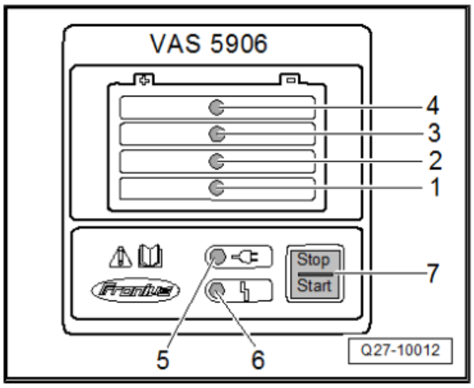
3 - 75% charge status indicator

4 - 100% charge status indicator

5 - Readiness indicator

6 - Damage indicator

7 - `Start/Stop` button and `Setup` button to interrupt and resume the charging process.



3.5.2 Operation mode of the Battery charger - VAS 5906-

> ⚠ WARNING
>
> *Risk of injuries! Pay attention to the warning notes and security norms* *⇒ page 3* .

ℹ Note

- *The Battery - A- must be at a minimum temperature of 10°C.*
- *Do not open the caps of batteries with removable caps during charging.*

– Turn off the ignition and all electrical equipment.

– Connect the Battery charger - VAS 5906- to a power source.

– Connect the red charging terminal “+” of the charger to the positive pole of the Battery - A- .

– Connect the black charging terminal “-” of the charger to the negative pole of the Battery - A- .

Charging begins in approximately 2 seconds.

The LEDs indicate the charging status of the Battery - A- . When all LEDs are lit, the Battery - - is charged.

When the Battery - A- is completely charged, the Battery charger - VAS 5906- automatically switches to maintenance (trickle) charging mode.

Caution

Sparkles may be generated if the Battery charger cable terminals are removed without pressing the `START/STOP` *button.*

Finalizing Battery - A- charging:

- Press the `START/STOP` button.
- Remove the Battery charger cable terminals from the battery.
- Disconnect the Battery charger - VAS 5906- from the power source.

3.6 Battery charger - VAS 5908-

⇒ "3.6.1 Battery charger VAS 5908 - general description", page 66

⇒ "3.6.2 Automatic mode with the battery charger VAS 5908 ", page 67

⇒ "3.6.3 Charging batteries with the battery charger VAS 5908 ", page 69

⇒ "3.6.4 Support function with the Battery charger VAS 5908 ", page 71

⇒ "3.6.5 VAS I-CHECK current consumption test with the battery charger VAS 5908 ", page 73

3.6.1 Battery charger - VAS 5908- - general description

Note

- *In case of software updates or instant updates, a charger with a minimum charging current of 70 A must be used to avoid issues during these procedures.*
- *"VAS 5903" ⇒ "3.4 Battery charger VAS 5903 ", page 53*
- *"VAS 5908" ⇒ "3.6 Battery charger VAS 5908 ", page 66*

The battery charger - VAS 5908- features the following modes:

- `AUTO-MODUS`, conservation charging with automatic charge detection (battery or electrical equipment) ⇒ page 67
- `LADE-MODUS`, battery charging with configurable parameters ⇒ page 69
- `FSV-MODUS`, external electrical supply (support mode) ⇒ page 71
- `I-CHECK`, current consumption test with short cell testing ⇒ page 73

Technical data

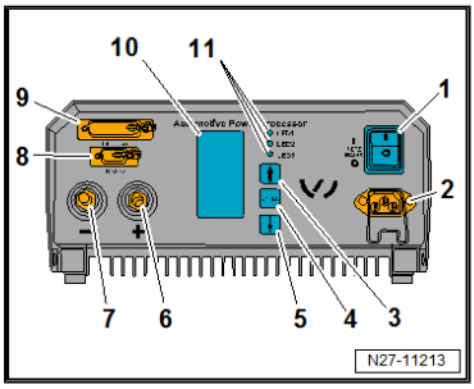
- Input voltage: 100-240 V CA
- Output voltage: 14.4 VCC (13.2 VCC with conservation charging)
- Charging current: 90 A (max. 105 A)
- Weight: 8.2 kg

Replacement parts

- 5-m charging cable - VAS 5908/1-
- Charging dock - VAS 5908/2-

Additional information: ⇒ Instruction manual of the battery charger - VAS 5908- .

Device overview - Battery charger - VAS 5908-



1 - “ON/OFF” electrical grid switch

2 - Grid cable connection

3 - ▲ UP menu selection button

4 - ENTER menu selection or Start button

5 - ▲ DOWN menu selection button

6 - + battery charging terminal connection (red clamp)

7 - – battery charging terminal connection (black clamp)

8 - RS232 9-pole communication interface

9 - 25-pole signal interface

10 - Menu selection display

11 - LED indicator to indicate device and operating conditions

LED indicator -11-

The LED indicator on the front of the unit indicates device and operating conditions. A table detailing the meaning of LEDs flashing or lit in green, yellow or red in different operating conditions is provided in the ⇒ Instruction manual of the Battery charger - VAS 5908- , 8) Remote indicator and LED indicators .

Device menu

The device menu allows presetting multiple basic settings and parameters to protect measurement values and connection/disconnection behaviour of the battery charger - VAS 5908-.

– Turn on the battery charger - VAS 5908- .
– Use the ▲▼ buttons to select »MENÜ« and press ENTER to confirm.
– Use the ▲▼ buttons to select the »GERÄTE MENÜ« submenu (Device menu) and press ENTER to confirm.

Additional information on the device menu: ⇒ Instruction manual of the Battery charger - VAS 5908- .

3.6.2 Automatic mode with the battery charger - VAS 5908-

Note

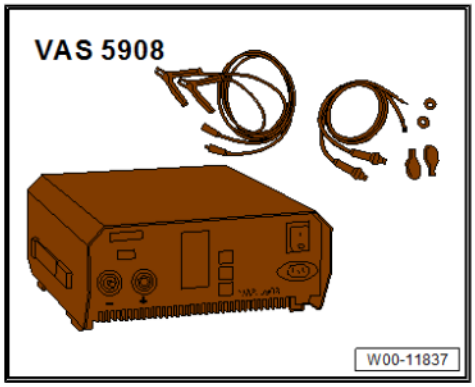
- *In case of software updates or instant updates, a charger with a minimum charging current of 70 A must be used to avoid issues during these procedures.*
- *“VAS 5903”* *⇒ “3.4 Battery charger VAS 5903 ”, page 53*
- *“VAS 5908”* *⇒ “3.6 Battery charger VAS 5908 ”, page 66*

»AUTO-MODUS« maintains electrical voltage (conservation charge), for example during diagnostic or transfer services. In

»AUTO-MODUS« mode, the battery charger - VAS 5908- uses its charging detector to automatically detect whether a battery or electrical component is connected with ohmic charge.

Special tools and workshop equipment required

- Battery charger - VAS 5908-



Start charging

Note

If the charging terminals are connected to an electrical component or battery, before switching the charger on, the battery charger - VAS 5908- automatically starts with a conservation charge in »AUTO-MODUS« shortly after being turned on.

– Turn on the battery charger - VAS 5908- .
– Use the ▲▼ buttons to select the AUTO-MODUS (Automatic mode) and press ENTER to confirm.
– Connect the “+” red charging terminal to the positive terminal of the vehicle battery.

Note

- *In vehicles equipped with Start-Stop system and battery control unit - J367- , the black charging terminal “-” must be connected to the body grounding point.*
- *If it is connected to the negative battery terminal, the battery control unit - J367- is cancelled. The cause may be faults in the Start-Stop system.*

– In vehicles equipped with Start-Stop system, connect the “-” charging terminal to the body grounding point
– In vehicles not equipped with Start-Stop system, connect the “-” black charging terminal to the negative battery terminal.

OR

– Connect the charging terminals to the correct terminals of electrical components with ohmic charge.
– Use the ▲▼ buttons to select START in the menu and press ENTER to confirm and start charging.

Note

The battery charger - VAS 5908- automatically sets limit values to the current and voltage in Automatic mode.

Stop charging

– Use the ▲▼ buttons to select STOP in the menu and press ENTER to confirm and stop charging.
– Turn off the battery charger - VAS 5908- .
– Disconnect the "-" black charging terminal from the negative terminal in the vehicle battery or electrical component.
– Disconnect the "+" red charging terminal from the positive terminal in the vehicle battery or electrical component.
– Remove the battery charger's connector.

3.6.3 Charging batteries with the battery charger - VAS 5908-

Note

- *In case of software updates or instant updates, a charger with a minimum charging current of 70 A must be used to avoid issues during these procedures.*
- *"VAS 5903"* *⇒ "3.4 Battery charger VAS 5903 ", page 53*
- *"VAS 5908"* *⇒ "3.6 Battery charger VAS 5908 ", page 66*

WARNING

Risk of injuries! Follow the safety warnings and the safety standards ⇒ page 3 !

WARNING

A - Batteries- showing a »bright yellow colour or no colour« in the battery window must not be tested or charged. Do not jump start the vehicle!

Risk of explosion during testing, charging or jump starting.

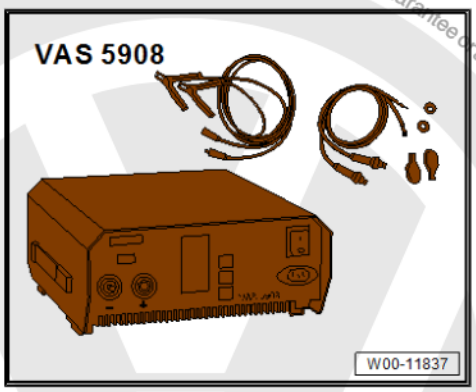
These batteries must be replaced.

Note

- *Follow the warnings provided in the chapter titled »Fully discharged batteries«* *⇒ page 75* .
- *Fully discharged batteries in unlicensed vehicles must be replaced before provisioning. Prior damages cannot be removed.*
- *The minimum battery temperature is 10°C.*
- *The minimum "Uesp" voltage of the battery to be charged must be at least 5 V.*

Special tools and workshop equipment required

- Battery charger - VAS 5908-



Battery - charging

– Turn off the ignition and all electrical devices and remove the ignition key.
– Turn on the battery charger - VAS 5908- .
– Connect the “+” red charging terminal to the positive terminal of the vehicle battery.

Note

- *In vehicles equipped with Start-Stop system and battery control unit - J367- , the black charging terminal “-” must be connected to the body grounding point.*
- *If it is connected to the negative battery terminal, the battery control unit - J367- is cancelled. The cause may be faults in the Start-Stop system.*

– In vehicles equipped with Start-Stop system, connect the “-” charging terminal to the body grounding point
– In vehicles not equipped with Start-Stop system, connect the “-” black charging terminal to the negative battery terminal.
– Use the ▲▼ buttons to select the LADE-MODUS (Charging mode) and press ENTER to confirm.

Note

- *The battery charger - VAS 5908- automatically sets limit values to the current and voltage in Charging mode.*
- *Pre-configure current and voltage tolerances in the charging menu ⇒ page 71 .*

Stop battery charging

– Turn off the battery charger - VAS 5908- .
– Disconnect the “-” black charging terminal from the negative terminal in the vehicle battery.
– Disconnect the “+” red charging terminal from the positive terminal in the vehicle battery.
– Remove the battery charger's connector.

Note

For optimal performance and durability, the battery charger - VAS 5908- automatically switches to conservation charging after the battery is fully charged.

Charging menu

The battery charger automatically sets limit values to the current and voltage in Charging mode. The charging mode parameters can also be manually adjusted.

– Use the ▲▼ buttons to select »MENÜ« and press ENTER to confirm.
– Use the ▲▼ buttons to select the »LADE MENÜ« submenu (Charging menu) and press ENTER to confirm.

Additional information on the charging menu: ⇒ Instruction manual of the Battery charger - VAS 5908- .

3.6.4 Support function with the Battery charger - VAS 5908-

Note

- *In case of software updates or instant updates, a charger with a minimum charging current of 70 A must be used to avoid issues during these procedures.*
- *"VAS 5903"* *⇒ "3.4 Battery charger VAS 5903 ", page 53*
- *"VAS 5908"* *⇒ "3.6 Battery charger VAS 5908 ", page 66*

The support mode (»FSV-MODUS« - External current supply) provides voltage to the electrical grid when the battery is disconnected or removed.

Support function is suitable for the following applications:

- Supporting operations of electrical vehicle grids without an installed battery
- Maintenance of voltage when replacing batteries
- Assembly testing without a battery

Caution

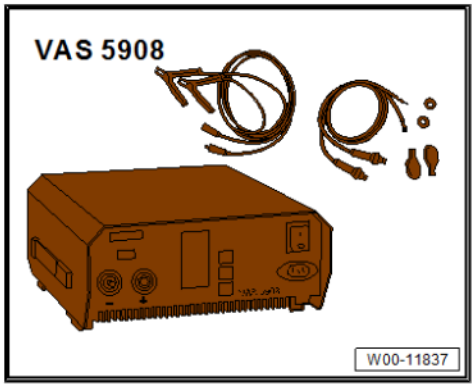
»FSV-MODUS« only requires supplying an ohmic charge (electrical component).

»FSV-MODUS« cannot be used while the battery is connected.

Before using »FSV-MODUS«, disconnect or remove the battery.

Special tools and workshop equipment required

- Battery charger - VAS 5908-



Run support mode

– Turn off the ignition and all electrical devices and remove the ignition key.
– Remove the battery ⇒ Electric system; Rep. gr. 27 ; Battery - remove and install
– Turn on the battery charger - VAS 5908- .

Caution

Always check if the red charging terminal is not connected to the body grounding point for safety reasons.

Always check if the battery terminals are not connected for safety reasons.

– Connect the “+” red charging terminal to the positive terminal of the vehicle battery.

Note

- *In vehicles equipped with Start-Stop system and battery control unit - J367- , the black charging terminal “-” must be connected to the body grounding point.*
- *If it is connected to the negative battery terminal, the battery control unit - J367- is cancelled. The cause may be faults in the Start-Stop system.*

– In vehicles equipped with Start-Stop system, connect the “-” charging terminal to the body grounding point
– In vehicles not equipped with Start-Stop system, connect the “-” black charging terminal to the negative battery terminal.

Note

- *The battery charger - VAS 5908- automatically sets limit values to the current and voltage in support mode.*
- *Pre-configure current and voltage tolerances in the FSV Menu ⇒ page 73 .*

– Select FSV-MODUS (FSV Mode) using the ▲▼ buttons and press ENTER to confirm.

Stop the support function

– Turn off the battery charger - VAS 5908- .

– Disconnect the "-" black charging terminal from the negative terminal in the vehicle battery.
– Disconnect the "-" red charging terminal from the positive terminal in the vehicle battery.
– Remove the battery charger's connector.

FSV Menu

The battery charger automatically sets limit values to the current and voltage in support mode. The support mode parameters can also be manually adjusted.

– Use the ▲▼ buttons to select »MENÜ« and press ENTER to confirm.
– Use the ▲▼ buttons to select the »FSV MENÜ« submenu (FSV menu) and press ENTER to confirm.

Additional information on the FSV menu: ⇒ Instruction manual of the Battery charger - VAS 5908- .

3.6.5 VAS I-CHECK current consumption test with the battery charger - VAS 5908-

Note

- *In case of software updates or instant updates, a charger with a minimum charging current of 70 A must be used to avoid issues during these procedures.*
- *"VAS 5903"* *⇒ "3.4 Battery charger VAS 5903 ", page 53*
- *"VAS 5908"* *⇒ "3.6 Battery charger VAS 5908 ", page 66*

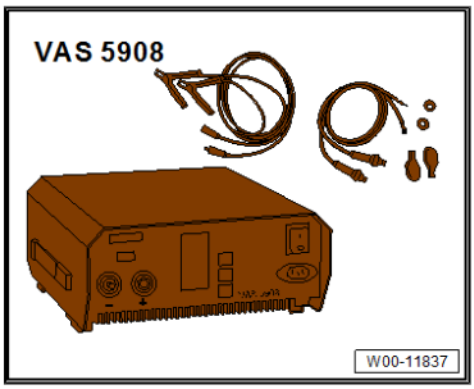
The current consumption tests provides a quick diagnostic of the discharged battery's conditions. The results of the current consumption test allow determining whether the battery must be replaced or fully charged.

Note

To perform the battery's current consumption test, it is necessary to check whether the battery will be tested without any electrical component connected in parallel.

Special tools and workshop equipment required

- Battery charger - VAS 5908-



Perform current consumption test

– Disconnect both battery terminals to avoid interference in test results due to the vehicle's electrical components ⇒ Electrical system; Rep. gr. 27 ; Battery - connect and disconnect .

– Turn on the battery charger - VAS 5908- and connect the battery to the correct charging terminals.

– Use the ▲▼ buttons to select »AUTOMODUS« and press ENTER to confirm (indicator flashes).

– Use the ▲▼ buttons to select the I-CHECK mode and press ENTER to confirm.

– Enable »Qbat:« battery capacity input by pressing ENTER (flashing).

– Use the ▲▼ buttons to set the capacity (Ah) of the battery to be tested and press ENTER to confirm.

– Use the ▲▼ buttons to select »TEST START« in the menu and press ENTER to confirm and start the current consumption test. Check for possible connection error messages ⇒ page 75 .

The »TEST« indicator flashes on the display during the current consumption test. Buttons will be blocked and the test can only be interrupted by removing the charging terminals. Check for possible interruption error messages ⇒ page 75 .

End of test with current I consumption under 100% (defective battery)

If current consumption »I« at the end of the test is <100%, current supply to the battery is interrupted and the message »GEWÄHRLEISTUNGSANTRAG AUSFÜLLEN« (Fill out warranty request) appears on the display.

– Use the ▲▼ »OK« buttons and press ENTER to show test results.

In the test results window, the current consumption percentage is shown in »I«. The data can be transferred to the battery test sheet.

– Use the ▲▼ »TEST ENDE« (End test) buttons and press ENTER to end the current consumption test.

Test ended with result I higher than 100% (batter in good conditions, but with insufficient charge)

At the end of the test, if the current consumption »I« is >100 %, current supply to charge the battery will be maintained.

– Use the ▲▼ »ERGEBNIS« (Results) buttons and press ENTER to show test results.

In the test results window, the current consumption percentage is shown in »I«.

– Use the ▲▼ buttons to select »OK« or »TEST ENDE« and press ENTER to switch to “I-Check charging mode” and continue charging the battery.

In I-Check charging mode, »LADEN« (Charge) flashes on the display until the battery if fully charged. After the charging process ends, the device automatically switches to conservation charge. The lettering »ERHALTUNG« (Conservation) flashes on the display when this happens.

Note

- *While charging the battery in "I-Check charging mode", an active short cell test is automatically performed.*
- *With the short cell test activated, battery charging is interrupted twice for approximately 30 seconds to measure the voltage.*
- *If the short cell test is positive, the charging process is interrupted and »ZELLENSCHLUSS« (Short cell) is shown on the display.*

Connection error messages

- »ANWENDUNGSFEHLER - KONTAKT« = (Use error - contact) No battery detected or connected.
- »ANWENDUNGSFEHLER - VERPOLUNG« = (Use error - terminals) Incorrect battery terminals connected.
- »ANWENDUNGSFEHLER - TIEFENTLADEN« = (Use error - Battery fully discharged) The voltage position of the connected battery is below the connection voltage limit (Uesp) set in the Charging menu.

Interruption error messages

- »ANWENDUNGSABBRUCH - KONTAKT« = (Use interruption - Contact) Battery disconnected during test.
- »ANWENDUNGSABBRUCH - KURZSCHLUSS« = (Use interruption - Short circuit) Short circuit in battery terminals.

3.7 Completely flat batteries

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3.

The Battery - A- is considered "completely flat" when it has a quiescent voltage of less than 12.2 V.

Caution

- *Completely flat batteries suffer from premature sulphate build-up.*
- *Batteries with sulphate build-ups cannot be reused.*

Note

- *Batteries that have not been operating for some time, for example those in stored vehicles, drain themselves.*
- *In flat batteries, the electrolyte (a water and sulphuric acid mix) is almost entirely made up of water, as the amount of the acid is very low.*
- *Completely flat batteries suffer from sulphate build-up, in other words, the total surface area of the plates in the battery hardens.*
- *Completely flat batteries that are immediately recharged after being discharged do not suffer from sulphate build up.*
- *If these batteries are nor recharged, the boards continue hardening and the charge recovery capacity diminishes. Accordingly, the power of the Battery - A- is also reduced.*

– Check the resting voltage of the battery - A- ⇒ page 33 .

– Charge the Battery - A- :

Charging the Battery - A- with the Battery charger - VAS 5095A- ⇒ page 36 .

Charging the Battery - A- with the Battery charger - VAS 5900- ⇒ page 41 .

Charging the Battery - A- with the Battery charger - VAS 5900A- ⇒ page 41 .

Charging the Battery - A- with the Battery charger - VAS 5903- ⇒ page 54 .

Charging the Battery - A- with the Battery charger - VAS 5906- ⇒ page 65 .

3.8 Battery (Delphi) - charging procedure

⇒ “3.8.1 Completely flat batteries”, page 77

⇒ “3.8.2 Charging a single Battery A or rapid charging ”, page 77

⇒ “3.8.3 Charging several batteries or parallel charging ”, page 77

⇒ “3.8.4 Charging several batteries - charging in series or slow charging ”, page 78

⇒ “3.8.5 Equalization of batteries”, page 79

WARNING

Risk of injuries! Pay attention to the warning notes and security norms ⇒ page 3 .

Note

Quick charging is recommended for Delphi batteries. This procedure does not damage the product and makes it the process much faster.

WARNING

The Battery - A- charging time depends on the capacity of the charger, and the capacity and state of the charge of the Battery - A- .

Monitor the charging procedure attentively.

Keep poles, cables and connections clean and in good condition. Ensure adequate electrical contact in connections.

Charge the Battery - A- at room temperature, in a well-ventilated area.

3.8.1 Completely flat batteries

Batteries whose voltage is below 11 V take some time to show that they are accepting a charge.

The low initial voltage may not activate the chargers with protection against reversed load, even though the connections may be correct. Consult the instructions of the charger manufacturer on how to activate the loop in this situation.

After charging, test the Battery - A- ⇒ page 7 .

3.8.2 Charging a single Battery - A- or “rapid charging”

– Connect the Battery - A- to the charger.
– Turn on the charger ⇒ page 35 .
– Set the charger to a voltage of 16 V, if possible.
– Set the charger to maximum current.

WARNING

Monitor the charging procedure attentively.

- *Leaking, emanation of gas from vents or over-heating (above 52° C) should not occur. If such things do occur, reduce the charging rate (current).*
- *Monitor the inspection window on the battery. If a green colour appears and remains, the charge is sufficient for the Battery - A- to be tested.*

– Turn off the charger .
– Test the Battery - A- ⇒ page 7 .

3.8.3 Charging several batteries or “parallel charging”

Note

Equalize the batteries, if necessary ⇒ page 79

– Connect the batteries in parallel. The charger must have at least 10A available per Battery - A- .
– Turn on the charger ⇒ page 35 .
– Set the charger to a voltage of 16 V, if possible.

– Set the charger to maximum current.

> **WARNING**
>
> *Monitor the charging procedure attentively.*
>
> - *Leaking, emanation of gas from vents or over-heating (above 52º C) should not occur. If such things do occur, reduce the charging rate (current).*
> - *Monitor the inspection window on the battery. If a green colour appears and remains, the charge is sufficient for the Battery to be tested.*

– Turn off the charger .
– Test the batteries ⇒ page 7 .
– Continue charging still discharged batteries whose inspection windows feature a dark colour.
– Only interrupt charging after the time specified for charging this group of batteries has elapsed.

3.8.4 Charging several batteries - charging in series or “slow charging”

Note

- *For charging in series, it is important to place the batteries with the same capacity and state of charge (through equalization) on the same loop, because the current will be the same for all of them.*
- *Equalize the batteries, if necessary ⇒ page 79*

– Connect the batteries in series.
– Turn on the charger ⇒ page 35 .
– Set the charger to maximum current.

> **WARNING**
>
> *Monitor the charging procedure attentively.*
>
> - *Leaking, emanation of gas from vents or over-heating (above 52º C) should not occur. If such things do occur, reduce the charging rate (current).*
> - *Monitor the inspection window on the battery. If a green colour appears and remains, the charge is sufficient for the Battery to be tested.*

– Turn off the charger .
– Remove the batteries and test them ⇒ page 7 .
– Continue charging still discharged batteries whose inspection windows feature a dark colour.

DANGER!

- *With recharging in series, voltages are combined, thus there is a risk of electric shock.*
- *Cables and connectors should be handled with care.*

3.8.5 Equalization of batteries

Equalization of batteries should be carried out with batteries that have 0.10V or more of difference between them. They should be connected in parallel for at least 12 hours before charging, notwithstanding the number of units. Equalization is more efficient when the batteries have similar capacities.

Note

Batteries with less than 11V do not require equalization, because these are considered to have 0% charge.

4 Speed regulator (GRA)

⇒ “4.1 Speed regulator (GRA) - activating/deactivating”, page 80

General description:

The function of the speed regulator are commanded by the Engine control unit - J623- .

The only command is the Cruise control switch (speed regulator) - E45- located on the levers of the direction indicators (set of commuters).

– To remove the Cruise control switch (speed regulator) - E45- , the set of commuters should be removed ⇒ Electrical equipment; Rep. gr. 94 ; Switches, lights and external bulbs .

The speed regulator can be activated/deactivated ⇒ page 80 .

Troubleshooting:

The speed regulator is equipped with self-diagnosis, which facilitates troubleshooting.

For troubleshooting, use the Vehicle diagnostic, testing and information system - VAS 5052A- or later equipment, in the operation mode “Guided fault finding”.

– Connect the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment ⇒ page 94 .

4.1 Speed regulator (GRA) - activating/deactivating

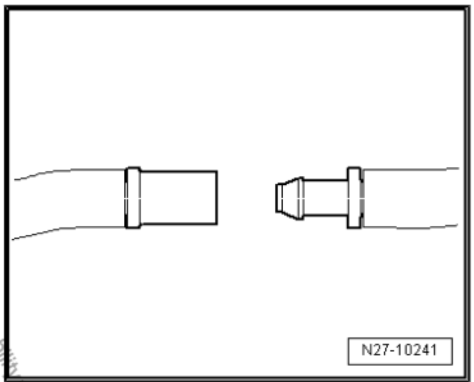
To activate or deactivate the speed adjuster (GRA), you must use the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment.

– Connect the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment to the 16-pin diagnosis connector - T16- ⇒ page 94 .

92 – Windscreen wash/wipe system

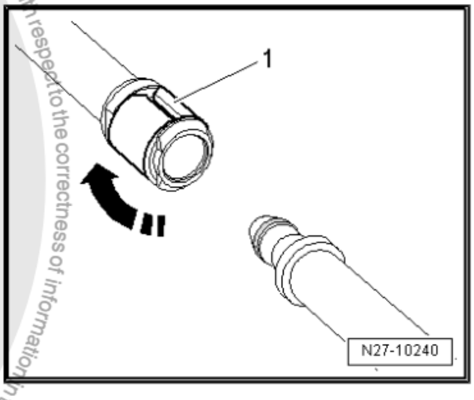
1 Washer hoses - connecting and disconnecting

Without locks:



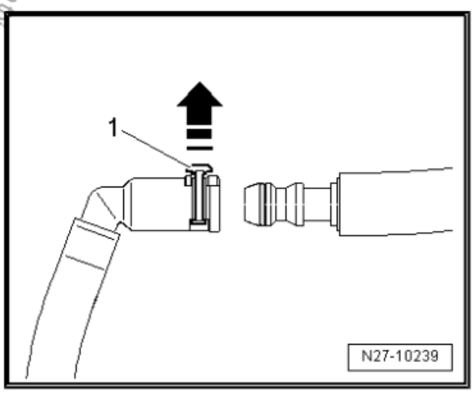
– To loosen the connection, separate the two parts of the coupling.
– To unite the connection, compress the two coupling parts against each other, until they slot in with a click.

With a locking ring:



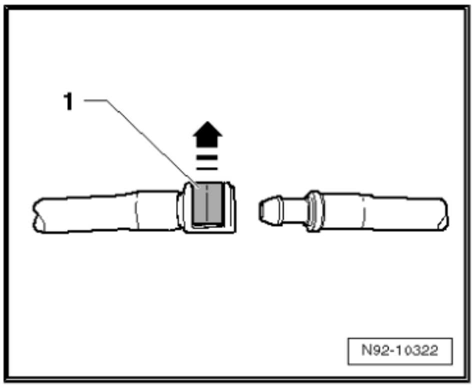
– To loosen the connection from the locking ring, turn the ring -1- 90° -arrow- and remove the connection from the hose.
– To join the connection, slot it in and turn the ring -1- -arrow-, until it locks.

With a safety clamp:



– To loosen the connection, raise the safety clamp -1-, approx. 1mm -arrow- and remove the hose connection.
– To unite the connection, slot in the hose and push the safety clamp in -1-, until it locks.

With lock:



– To loosen the connection, pull the lock -1- according to -arrow- and remove the connection from the hose.
– To unite the connection, slot in the hose and push the lock in -1-, until it locks.

2 Washer hoses - repair

⇒ “2.1 Repairing smooth hoses”, page 82

⇒ “2.2 Repairing wrinkled hoses”, page 82

A new concept in repairs was developed to repair the hoses of the washer system. Several connections, special EPDM (ethylene propylene diene Monomer) rubber hoses and thermo-retractable hoses are available as replacement parts.

General description:

- The replacement parts are in the Electronic Parts Catalogue (ETKA).
- The replacement parts are available to repair both smooth hoses and wrinkled hoses.

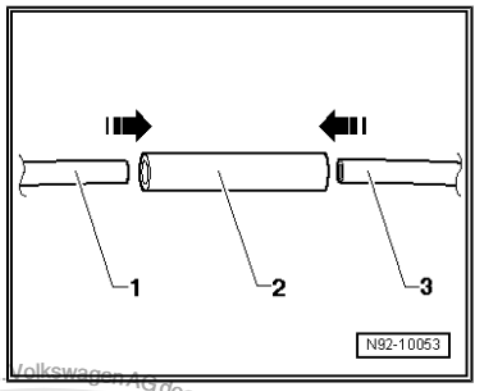
2.1 Repairing smooth hoses

Smooth hoses with a diameter of 5x1 mm or 6x1 mm can be repaired with an EPDM hose, according to the following recommendation:

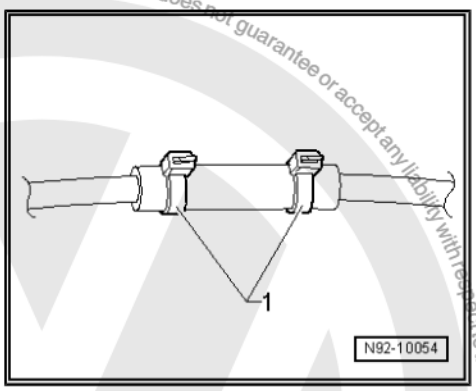
– Cut the damaged section of the smooth hose.

– Determine the corresponding EPDM hose -2- and the cable clamps from the Electronic Parts Catalogue.

– When determining the length of the EPDM hose -2-, do it in such a way that the ends of the smooth hoses -1- and -3- can be inserted approximately 100mm into the EPDM hose -2-.



– Fasten the repair section with cable clamps -1-.



2.2 Repairing wrinkled hoses

Special tools and workshop equipment required

- Hot air blower - VAS 5179- or Hot air blower - VAG 1416- or Hot air blower - VAS 1978/14-

Note

- *The section to be repaired cannot be subject to stress or twisting.*
- *If the damaged section is more than 0.79 in long, a new segment of hose will have to be installed, and the work sequence described below will have to be repeated.*

Execute the following tasks:

– Cut the damaged section of the wrinkled hose.

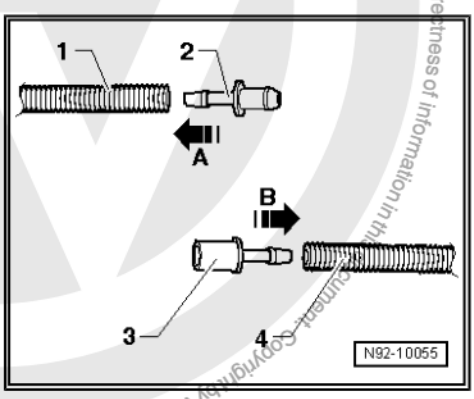
– Choose the connections -2- and -3- and the appropriate thermo-retractable hose from the Electronic Parts Catalogue (ETKA).

– Carefully heat the end of the wrinkled hose -1-.

– Insert the connection -2- into the wrinkled hose -1- according to -arrow A-.

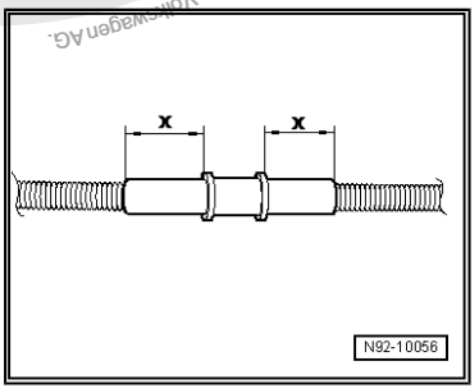
– Heat the end of the wrinkled hose -4-.

– Insert the connection -3- into the wrinkled hose -4- according to -arrow B-.



– When determining the length of the thermo-retractable hose, do it in such a manner that the end of the wrinkled hose are covered by at least 20 mm -measurement x-.

– Push the thermo-retractable hose over the wrinkled hose, unite the connections and fasten the repaired section with the thermo-retractable hose.



94 – Lights, bulbs, switches - exterior

1 Adhere to the safety warnings and the application of gas-discharge lamps

In the event that assembly and disassembly work is carried out on the main headlights with gas-discharge lamps, observe:

- Warnings regarding the high voltage/ dangerous currents ⇒ page 84
- Warnings regarding curves, temperature, irradiation and illumination pressure ⇒ page 85
- Notes on the assembly of gas-discharge lamps ⇒ page 86
- Notes on the disposal of gas-discharge lamps ⇒ page 86

Special tools and workshop equipment required

- Safety goggles
- Sleeves

WARNING

Before carrying out any work on the headlight components with gas-discharge lamps indicated with high voltage symbols, the earth wire of the Battery - A- must be disconnected ⇒ Electric equipment; Rep. gr. 27 ; Starter, alternator, battery .

Then, turn off and turn on the headlights. This way, any residual current will be eliminated.

The gas-discharge lamp control device must not, under any circumstances, be operated without the gas-discharge lamps in place.

The gas-discharge lamps can only be operated in the headlight housing due to the elevated voltage (higher than 28000 V when the gas-discharge lamp is turned on) and temperatures.

WARNING

- *If the mechanic is not familiar with the bulb bearings, the safety norms and the tools, he is not apt to change these bulbs.*

Warnings regarding high voltage/ dangerous currents

WARNING

The control devices of the lighting system, the operational connectors or the components of bulb bearings are conductors of high voltage and are potentially fatal!

The command device and the ignition device can only be operated with the bulb in place.

WARNING

- *Turn off the ignition and all electrical devices, then remove the ignition key.*
- *Before working on the headlights, ensure that all components are free of voltage, including any residual voltage that may be in the system after the headlights have been turned off.*
- *Residual voltage is eliminated by turning the lights on and off, after removing the key from the ignition.*
- *Ensure that it is not possible to turn the lights on during any work on the headlights.*

Warnings regarding curves, temperature, irradiation and illumination pressure

WARNING

- *The bulb can only be operated in the headlight housing (protection from contact due to bulb heat, absorption of UV radiation, protection against chains, risk of explosion).*
- *The glass globes of incandescent bulbs get very hot - risk or burns!*
- *Avoid looking directly into the ray of light; because of the UV irradiation of this type of bulb, it is about 2.5 times greater than a conventional halogen bulb.*
- *Avoid looking directly into the ray of light (risk of blindness), since it can cause temporary loss of vision for a considerable period of time.*

WARNING

- *Avoid contact with the brushed glass globes*
- *The H7 incandescent bulbs and the gas-discharge lamps (Xenon/Bi-Xenon) are under pressure and may break during replacement - Risk of injuries.*
- *Operators must use safety goggles and gloves to install and remove gas-discharge lamps.*

Notes on the installation of gas-discharge lamps

Caution

- *Before replacing an incandescent bulb, always turn off its respective activator.*
- *Turn off the ignition and all electrical devices, then remove the ignition key.*
- *Do not touch the glass part of the bulb with your hands. Use fabric gloves. Any fingerprint would be dissipated by the heat emanating from the lit bulb and would move onto the reflector, thus compromising the intensity of the light.*
- *The incandescent bulb can only be replaced by a bulb of the same model.*
- *When installing, slot the fastenings into the correct position and ensure correct seating.*

Notes on the disposal of gas-discharge lamps

WARNING

- *Gas-discharge lamps should be disposed of as special trash; they must not be disposed of in conventional trash.*
- *Gas-discharge lamps contain metallic mercury (Hg) and traces of thallium. They cannot be destroyed.*
- *These components should be eliminated in compliance with current legal norms.*
- *Dispose of them at duly authorized disposal locations in suitable containers.*

96 – Lights, bulbs, switches - interior

1 12-V socket

⇒ “1.1 12-V socket - remove and install”, page 87

⇒ “1.2 Socket box light bulb L42 - remove and install”, page 87

1.1 12-V socket - remove and install

> **Caution**
>
> *In case of sockets without lights, blunt force may damage the fastening bushings.*
>
> *Only remove sockets (lighter) with lights using the T 40148 puller.*
>
> *In case of sockets without lighted fixtures, the puller cannot unblock the fitting bumps.*
>
> *In general, sockets without lighting cannot be removed without causing damages.*

Refer to Lighter - U1- - remove and install ⇒ page 88 .

1.2 Socket box light bulb - L42- - remove and install

The Socket box light bulb - L42- is removed similarly to the Lighter light bub - L28- ⇒ page 92 .

2 Lighter - U1-

⇒ “2.1 General description”, page 88

⇒ “2.2 Assembly overview”, page 89

⇒ “2.3 Lighter socket - remove and install”, page 90

⇒ “2.4 Cigarette lighter light bulb L28 - remove and install”, page 92

The following descriptions also apply to the Rear left lighter - U3- , rear right lighter - U7- , Rear lighter - U9- , Electric socket 2 - 12V - U18- , Electric socket 3 - 12V - U19- , Electric socket 4 - 12V - U20- , Lighter 2 - U25- e Electric socket 5 - 12V - U26- , as long as they are equipped with lights.

Caution

In case of sockets without lights, blunt force may damage the fastening bushings.

Only remove sockets (lighter) with lights using the T 40148 puller.

In case of sockets without lighted fixtures, the puller cannot unblock the fitting bumps.

In general, sockets without lighting cannot be removed without causing damages.

2.1 General description

Caution

In case of sockets without lights, blunt force may damage the fastening bushings.

Only remove sockets (lighter) with lights using the T 40148 puller.

In case of sockets without lighted fixtures, the puller cannot unblock the fitting bumps.

In general, sockets without lighting cannot be removed without causing damages.

Lighting in some vehicle equipment does not use incandescent bulbs, but LED lights (light emitting diode). These LEDs are connected to the fastening bushing and cannot be replaced separately.

There are several different models of fastening bushings with incandescent bulbs. One of the model that allows separately replacing the bulb and one where separate replacement is not possible. In this case, the socket must be replaced along with the bulb.

Due to different spatial construction conditions, there are several different sockets and lighter sockets. They have different lengths and electrical connections. Sockets or lighter sockets with harness extension may require additional work to access the connector.

2.2 Assembly overview

> **Caution**
>
> *In case of sockets without lights, blunt force may damage the fastening bushings.*
>
> *Only remove sockets (lighter) with lights using the T 40148 puller.*
>
> *In case of sockets without lighted fixtures, the puller cannot unblock the fitting bumps.*
>
> *In general, sockets without lighting cannot be removed without causing damages.*

1 - Lighter socket with harness extension

2 - Lighter

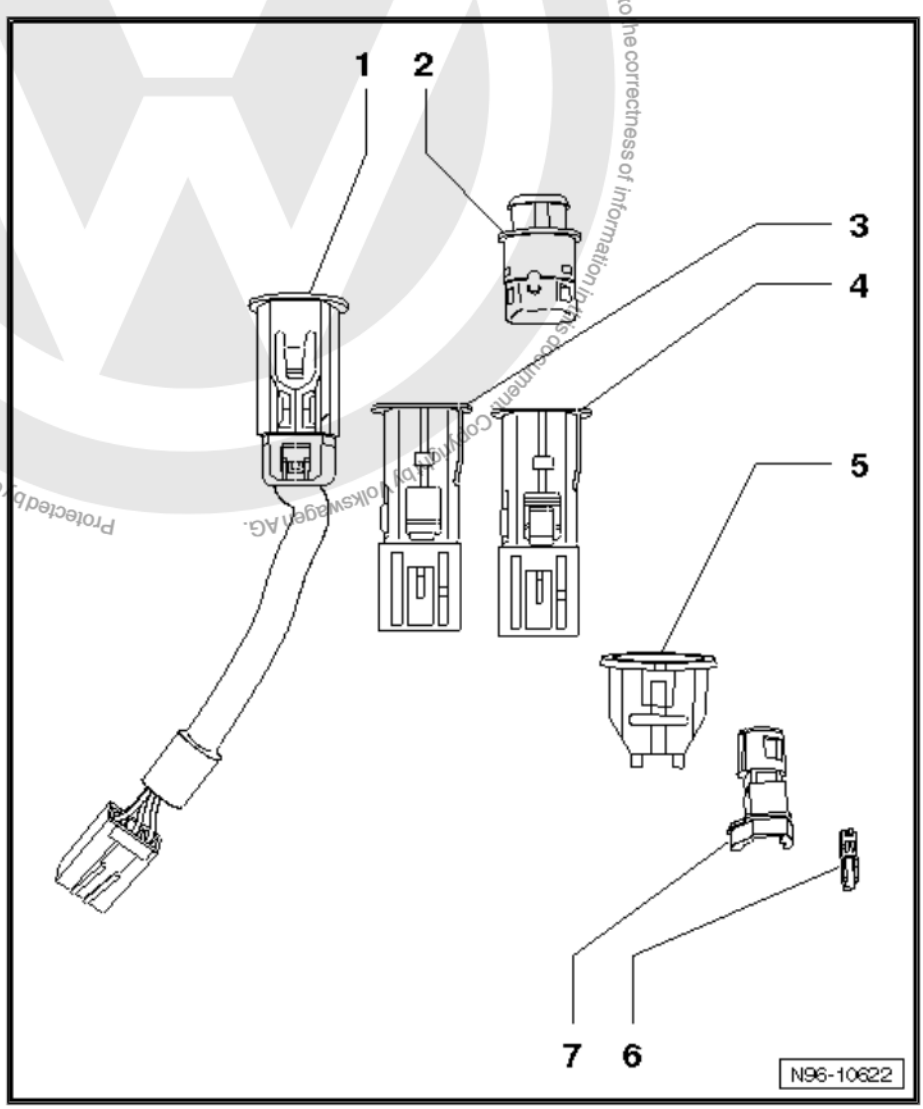
3 - Socket

4 - Lighter socket

5 - Spring pin

6 - W 5 12V, 1.2 Watt incandescent bulb

7 - Bulb carrier



2.3 Lighter socket - remove and install

Note

The following removal and installation procedures relate to the lighter socket and apply all other sockets.

Caution

In case of sockets without lights, blunt force may damage the fastening bushings.

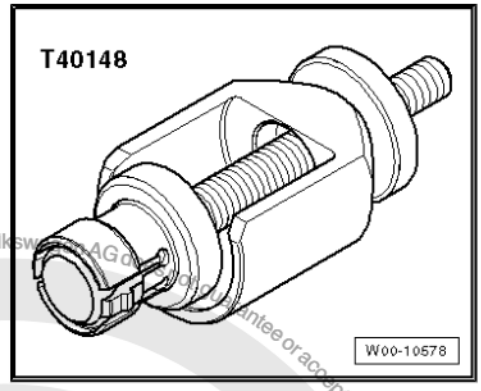
Only remove sockets (lighter) with lights using the T 40148 puller.

In case of sockets without lighted fixtures, the puller cannot unblock the fitting bumps.

In general, sockets without lighting cannot be removed without causing damages.

Special tools and workshop equipment required

- Puller - T 40148-



Removal:

– If necessary, remove the lighter, the mock lighter, etc. from the socket.

Note

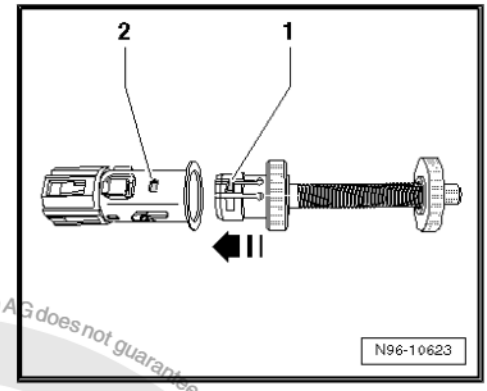
For a better general overview, the socket is illustrated after removal.

Caution

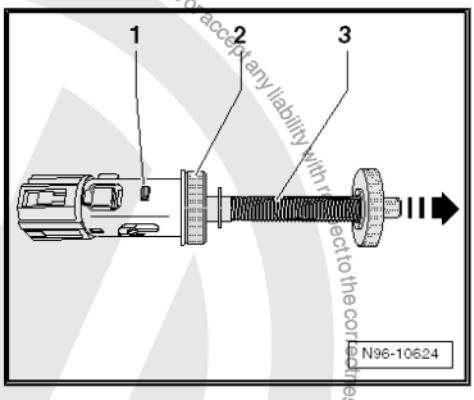
The socket or fastening bushing may be damaged.

Ensure the puller is seated properly, otherwise the spring pin claws will not be unlocked.

– Insert the puller -arrow- into the socket, fitting the bumps -1- onto the grooves -2-.

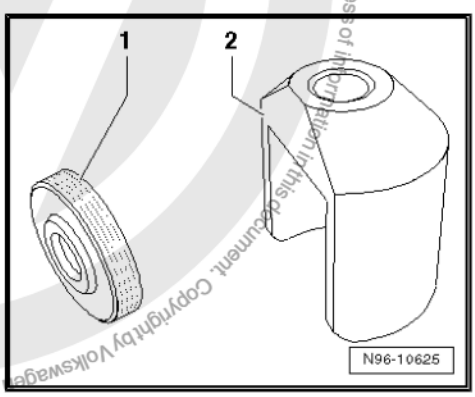


– Unlock the fastening bushing clips by pulling the claw -3- in the -direction of the arrow- .
– Remove the socket with the fastening bushing puller.



> Caution
>
> *Electrical socket cables may be damaged.*
>
> *Mind the length of the cable when extracting the socket.*

Depending on the assembly location, it may be recommended to use the pressure tool 40148/1 -2- with the knurled-edge nut -1-.



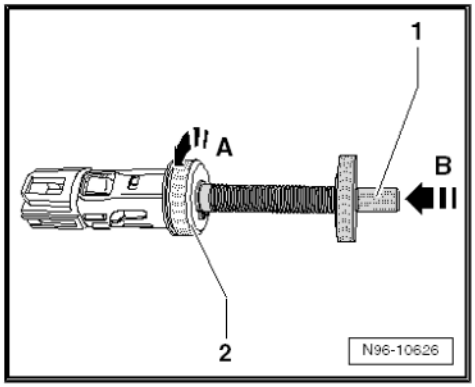
> Caution
>
> *When using the pressure tool, ensure no surrounding component is damaged.*

– Disengage the socket connection.

Note

Due to different spatial construction conditions, there are several different sockets and lighter sockets. They have different lengths and electrical connections. Sockets or lighter sockets with harness extension may require additional work to access the connector.

– Unlock the puller bumps by pressing the spindle -1- in the -direction of arrow B-. Next, the connection part -2- must be briefly turned to the left to be unlocked -arrow A-. Remove the puller out of the socket.



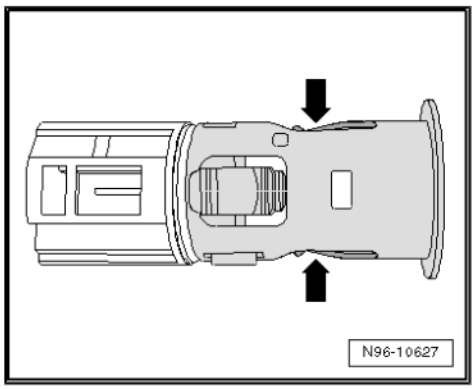
Note

Ensure the puller locks are not spread.

> Caution
>
> *The lighter may be ejected out of the socket after the incandescence process.*
>
> *To insert the puller, the socket lock springs are separated and the lock torque is reduced.*
>
> *Press the lock springs after removal and test if the lighter remains in removal position after the incandescence process.*

– Carefully press the socket's lock springs -arrows-.

– Test if the lighter remains in removal position and is not ejected towards the passenger compartment after the incandescence process.



Installation:

Installation is carried out in reverse sequence.

2.4 Cigarette lighter light bulb - L28- - remove and install

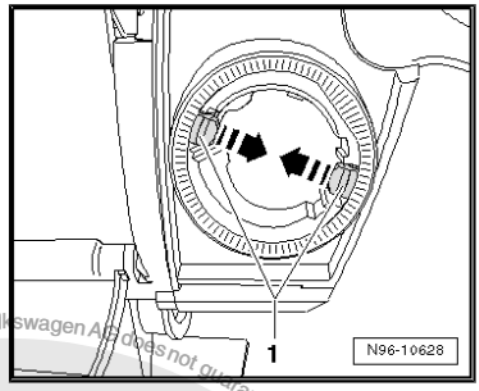
Note

- *Lighting in some vehicle equipment does not use incandescent bulbs, but LED lights (light emitting diode). These LEDs are connected to the fastening bushing and cannot be replaced separately.*
- *There are several different models of fastening bushings with incandescent bulbs. One of the model that allows separately replacing the bulb and one where separate replacement is not possible. In this case, the socket must be replaced along with the bulb.*

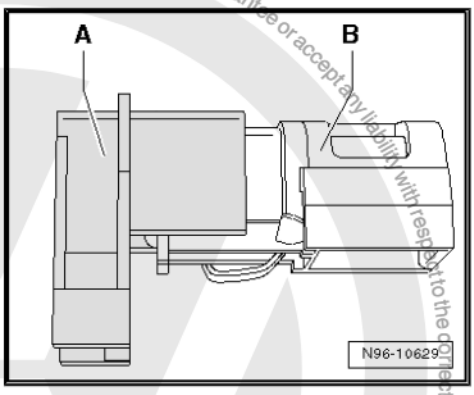
Removal:

– Remove the socket ⇒ page 90 .

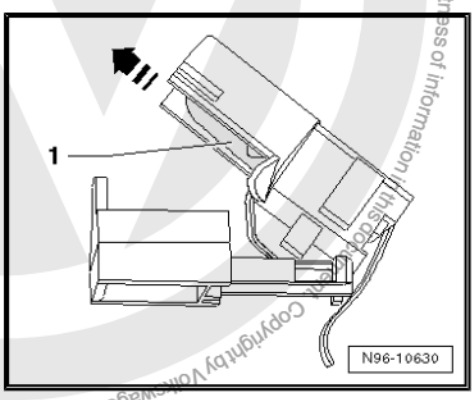
– Press the locking pawls -arrows- and remove the tensioning sleeve with the bulb bracket.
– Release the bulb bracket from the tensioning bushing.



– Disconnect the bulb bracket in area -A- and -B-.
– Open part -B- of the bulb bracket.



– Remove the incandescent bulb in the -direction of the arrow-.



Installation:

Installation is carried out in reverse sequence.

97 – Wiring

1 Vehicle diagnostic, testing and information system

WARNING

- *In test runs or during measurements with the Vehicle diagnostic, testing and information system, there is the possibility of serious, or even fatal, injuries!*
- *If the Vehicle diagnostic, testing and information system is placed within the radius of action of the airbag during a test run or when measurements are being taken, there is the possibility of serious, or even fatal, injuries, in the event that the airbag is accidentally triggered!*
- *Always install the measurement and test devices on the rear seat so that they can be used by another mechanic.*

Note

- *All work instructions described, such as: adjustments, encoding, etc., may be executed with Vehicle diagnosis system and technical information - VAS 5052A- or further equipment.*
- *All work-related information is available in the "Assisted troubleshooting" and "Guided functions"operational modes.*

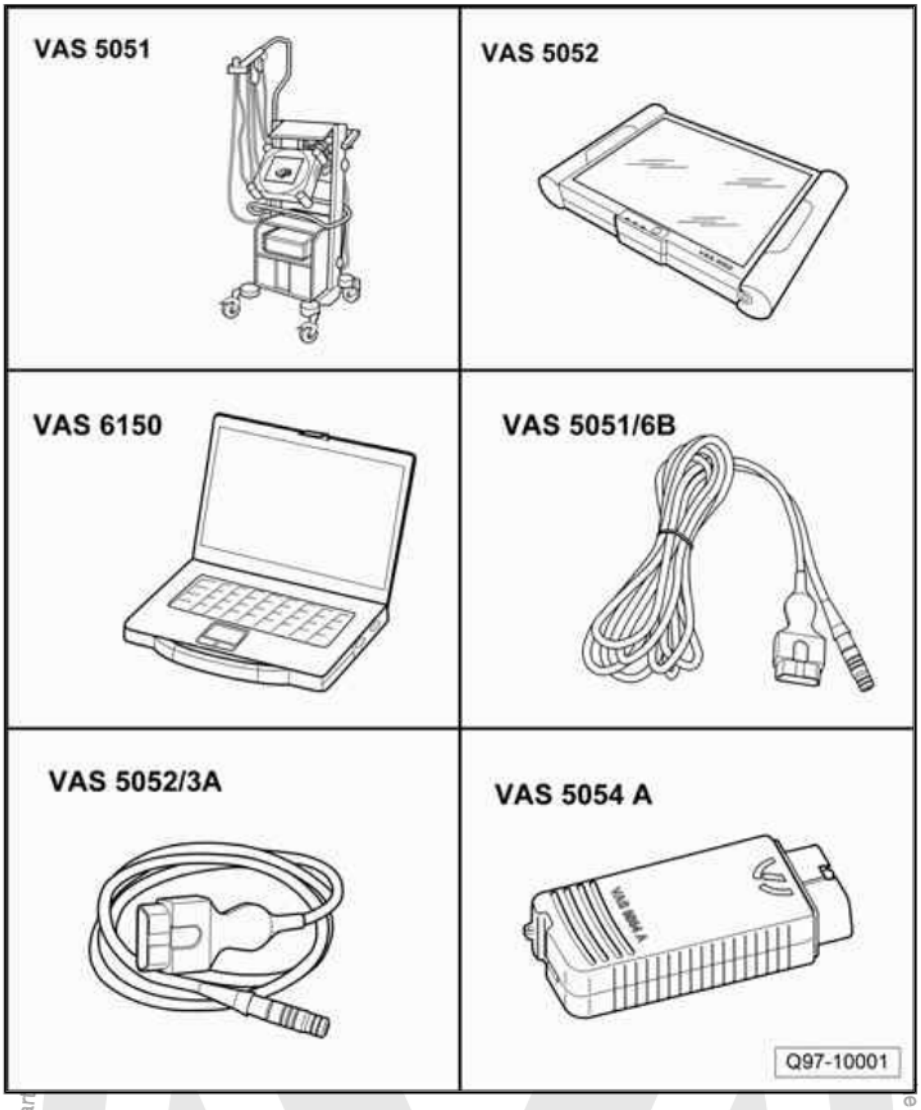
– Connect the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment ⇒ page 94 .

1.1 Vehicle Diagnosis, Measurement and Information System - connect

Note

Follow the current operational instructions of the Vehicle diagnostic, testing and information system - VAS 5052A- or further equipment, which is indicated through the selection of the "Administration" and "User Manual" buttons.

Special tools and workshop equipment required



- Vehicle diagnostic, testing and information system - VAS 5051-
- Vehicle diagnosis system and technical information - VAS 5052-
- Vehicle diagnosis system and technical information - VAS 5052A-
- Vehicle diagnosis system and technical information - VAS 6150-
- Diagnostic cable - VAS 5051/6B-
- Diagnostic cable - VAS 5052/3A-
- Wireless diagnostic connector - VAS 5054A-

Connect the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment:

– Operate the handbrake.

– In vehicles with manual transmission, put the gear change lever in the neutral position.

– In vehicles with automatic transmission, put the selector lever in position “P” or “N”.

– Remove the cover from the diagnostic terminal.

– Connect the Vehicle diagnosis system and technical information - VAS 5052A- or further equipment, with the ignition switched off, to the 16-pin diagnosis connector - T16- .
– Turn the ignition on.
– Turn off all electrical equipment.
– Keep on selecting the desired functions in the Diagnosis, measurement and information system - VAS 5052A- or later equipment ⇒ Vehicle diagnostic tester.

Note

The connection of other Vehicle diagnostic, testing and information systems is carried out in the same manner, as previously described.

2 Harness and connection repairs

⇒ “2.1 General notes on repair work on the electrical system of the vehicle”, page 97

⇒ “2.2 Harness repair kits”, page 98

⇒ “2.3 Description of tools”, page 100

⇒ “2.4 Harness repair”, page 103

⇒ “2.5 Fibre optic cable repairs”, page 123

⇒ “2.6 Aerial cable repairs”, page 130

⇒ “2.7 Repairing connector terminals and connectors”, page 142

⇒ “2.8 Unlocking and disassembling the terminals”, page 146

2.1 General notes on repair work on the electrical system of the vehicle

Caution

To turn the battery on and off, it is essential that the procedures described in the repair manual of the respective vehicle be followed to the letter.

WARNING

Some tools have a safety lock that should be inserted into the ends of the tool before it is used in order to prevent damage to the tool and to protect the mechanic from any injury.

- Whenever repair work is carried out, consult current information in the respective Repair Manuals.
- Follow the current specific norms of each country.
- Before working on the electrical system, it is necessary to disconnect the battery earth wire.
- Safe working conditions regarding the electrical system are created when the earth wire is disconnected from the battery (current interruption).
- The positive cable only needs to be disconnected when removing the battery.
- Before initiating any repair work, potential causes of faults must be eliminated (for example sharp elements on the vehicle body, defective components, corrosion, etc).
- Welding work must not be carried out on the on-board system.
- Repairs to the harnesses and terminals must only be carried out with the Harness repair set - VAS 1978- .
- Repairs to harnesses should only be carried out with yellow cables.
- Repairs to harnesses should not be reintegrated into the lining of the original harness of the vehicle. They should be identified with a yellow adhesive tape.
- These yellow cables and all locations identified with the yellow tape indicate previous repairs.

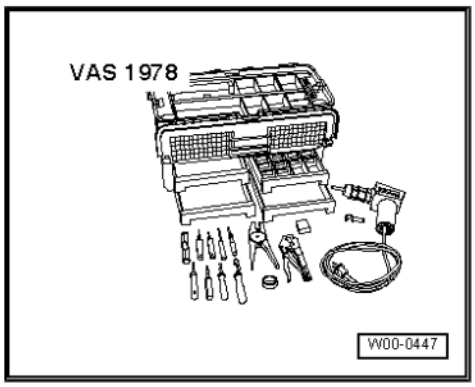
- Pressure connections must not be repaired. After compression, place a cable in parallel with the damaged cable.
- After compression, carry out retraction of the pressure connection with a hot air blower in order to prevent entry of humidity.
- Carefully observe the complementary notes regarding repair work on the airbag cables and the pre-tensioners of the seat belts, CAN-Bus system cables, antenna cables and cables with transversal section areas of up to 0.35 mm^2 ⇒ page 107 .
- Avoid releasing earth cables from the vehicle body (risk of corrosion).
- After each repair, carry out a test run. If necessary, consult and erase the fault memory and/or initialize or carry out and adjustment to the systems.

2.2 Harness repair kits

⇒ “2.2.1 Wiring harness repair set VAS 1978 ”, page 98
⇒ “2.2.2 Complementary set VAS 1978/50 ”, page 98
⇒ “2.2.3 Wiring harness repair set VAS 1978A ”, page 99
⇒ “2.2.4 Terminal removal tool kit VAS 1978/35 ”, page 99

2.2.1 Wiring harness repair set - VAS 1978-

The Harness repair set - VAS 1978- enables high-quality repairs to be carried out on the electrical system of the vehicle. The tools enable repairs to be carried out around the connectors and in the event of an interruption to the cables. Accordingly, repair cables complete with fixed terminals, connected to the original harness of the vehicle through pressure connections are used. Pressure pliers with three pressure cavities and a hot air blower for the retraction of the pressure connections ensure perfect electrical connection.

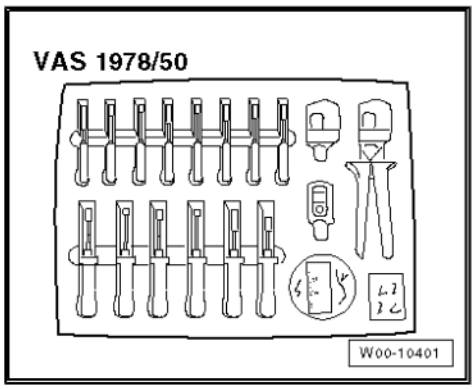


Note

Additional information: ⇒ Instructions manual Wiring harness repair set - VAS 1978-

2.2.2 Complementary set - VAS 1978/50-

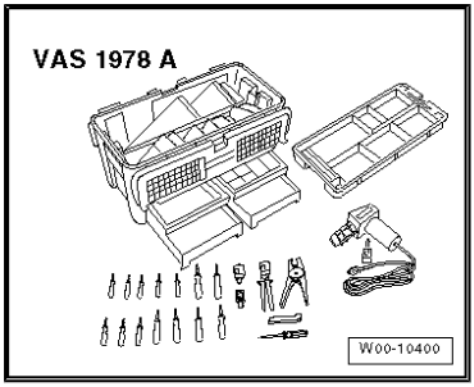
The Complementary set - VAS 1978/50- is necessary to update the “previous one” Harness repair set - VAS 1978- for the recent version of the Harness repair set - VAS 1978A- . The Wiring harness repair set - VAS 1978A- comprises 4 assembly tools and 10 disassembly tools and the new Crimping pliers (base tool) - VAS 1978/1–2- for pressure connectors with 0.35-2.5 mm2 Insertion element - VAS 1978/1-1- , Insertion element for the cleaving pliers - VAS 1978/2A- , Insertion element for the JPT contacts pliers - VAS 1978/9–1- . It also includes new self-adhesive items, an Instruction Manual, pressure connectors for conductors with a section of 0.35 mm^2 and a black felt tape roll.



Complementary set - VAS 1978/50-

2.2.3 Wiring harness repair set - VAS 1978A-

The new Wiring harness repair set - VAS 1978A- enables high-quality repairs to be carried out on the electrical system of the vehicle. The tools enable repairs to be carried out around the connectors and in the event of an interruption to the cables. Accordingly, repair cables complete with fixed terminals, connected to the original harness of the vehicle with the help of four types of pressure connections are used. A new set of Crimping pliers (base tool) - VAS 1978/1–2- with 0.35-2.5 mm2 insertion elements - VAS 1978/1-1- or Insertion element for crimping pliers - VAS 1978/2A- and a Hot air blower - VAS 1978/14- for the retraction of connections by pressure, thus ensuring a perfect electrical connection.



Wiring harness repair set - VAS 1978A-

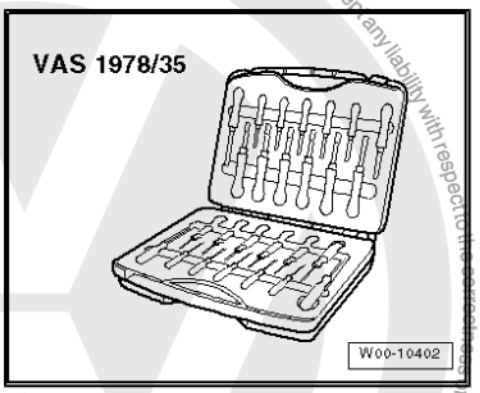
Note

Additional Information:

⇒ Instruction manual of the wiring harness repair set - VAS 1978A-

2.2.4 Terminal removal tool kit - VAS 1978/35-

The terminal removal tool kit - VAS 1978/35- is used to unlock different primary and secondary locks in the vehicles of the group of companies. The kit has 26 different tools to properly unlock or install, for example, round-fitting systems, flat contacts with one or to retainers, or also individual cable seals.



Check the table of the ⇒ Terminal removal tool kit -VAS 1978/35- to identify the correct unlocking tool for each respective lock.

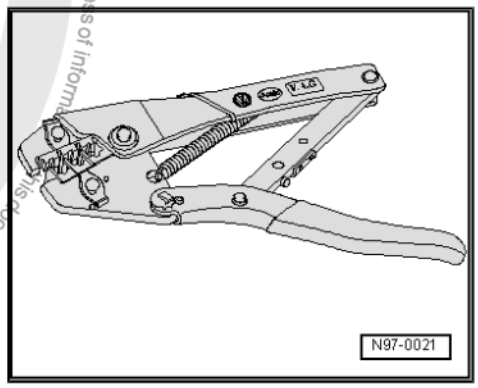
2.3 Description of tools

⇒ "2.3.1 Cleaving pliers VAS 1978/1 ", page 100
⇒ "2.3.2 Disassembly tool for terminals", page 100
⇒ "2.3.3 Assembly tool for simple cable linings", page 101
⇒ "2.3.4 Pliers for stripping cables VAS 1978/3 ", page 101
⇒ "2.3.5 Hot air blower VAS 1978/14 ", page 102
⇒ "2.3.6 Crimping pliers VAS 1978/1A ", page 102

2.3.1 Cleaving pliers - VAS 1978/1-

The Cleaving pliers without insertion element - VAS 1978/1- together with the Insertion element for cleaving pliers - VAS 1978/2- are part of the Harness repair set - VAS 1978- and are used to compress the connections by pressure in the repair of harnesses.

Pressure connection colour	Compression cavity colour	Transversal section
yellow	yellow	0,35 mm^2
red	red	0.5 mm^2 - 1.0 mm^2
blue	blue	1.5 mm^2 -2.5 mm^2
yellow	yellow	4.0 mm^2 -6.0 mm^2



Note

- *As an alternative to compress the connections, the Crimping pliers (base tool) - VAS 1978/1–2- may also be used together with the 0.35-2.5 mm2 Insertion element - VAS 1978/1-1- or the Insertion element for the cleaving pliers - VAS 1978/2A- .*
- *It is indispensable to ensure the correct compression cavity is used for the corresponding pressure connection.*
- *The cable lining must not be compressed.*

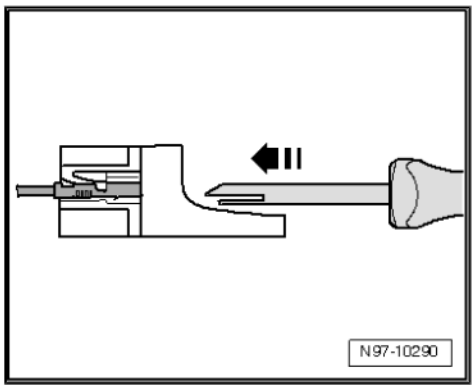
2.3.2 Disassembly tool for terminals

The different disassembly tools have designed to correctly disassemble the different types of terminals.

A series of disassembly tools are part of the Harness repair set - VAS 1978- / Harness repair set - VAS 1978A- .

WARNING

Some tools have a safety lock that should be inserted into the ends of the tool before it is used in order to prevent damage to the tool and to protect the mechanic from any injury.



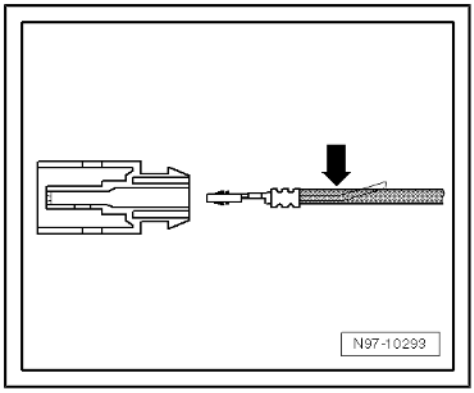
Disconnect and disassemble the terminals ⇒ page 146 .

2.3.3 Assembly tool for simple cable linings

The assembly tool enables linings of simple cables to inserted on the connector up to the stop and without damage, in such a way as to ensure the complete insulation between the simple cable and the connector.

The Harness repair set - VAS 1978- / Harness repair sets - VAS 1978A- includes four assembly tools for simple cable linings.

Assembly of simple cable linings ⇒ page 143 .



2.3.4 Pliers for stripping cables - VAS 1978/3-

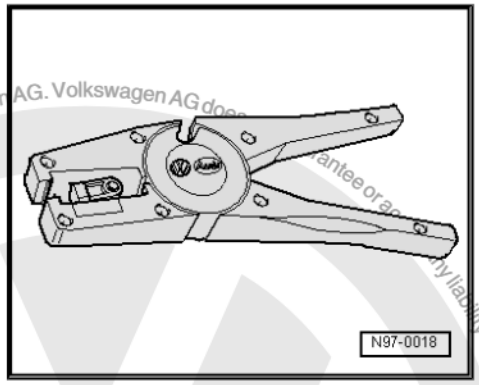
The Pliers for stripping cables - VAS 1978/3- are used to strip and cut cables.

The Pliers for stripping cables - VAS 1978/3- are part of Harness repair kit - VAS 1978- .

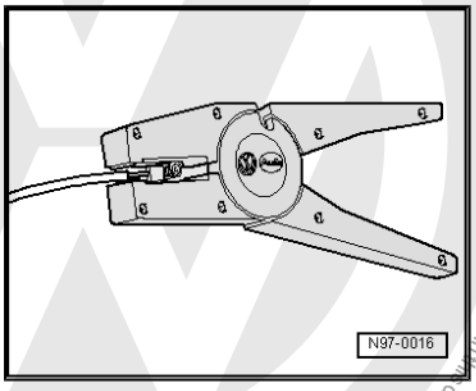
The Pliers for stripping cables - VAS 1978/3- has an adjustable limiter that permits the intended length of the lining to be removed from the cable to be adjusted.

Stripping:

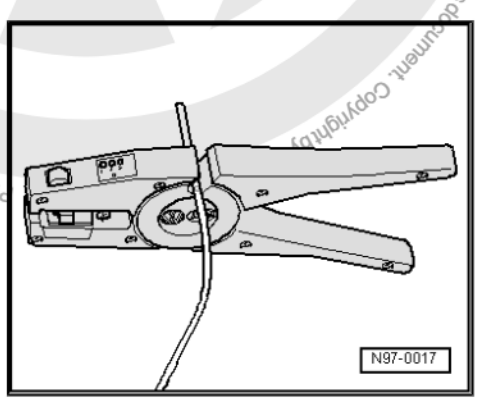
- Place the removable limiter on the pliers in the measurement of the length of lining to be stripped.



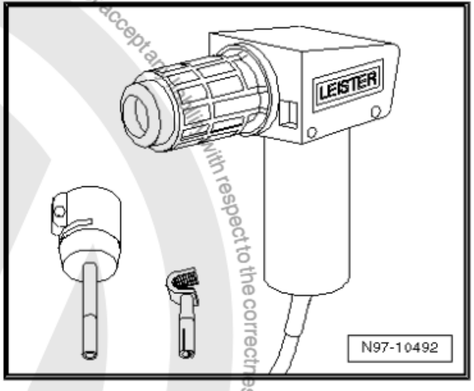
- Slot the end of the cable through the front section up to the limiter and press the pliers.
- Open the pliers and remove the end of the stripped cable.



- If necessary, cut the cable using the side cutting function on the upper section of the Pliers for stripping cables - VAS 1978/3- .



2.3.5 Hot air blower - VAS 1978/14-



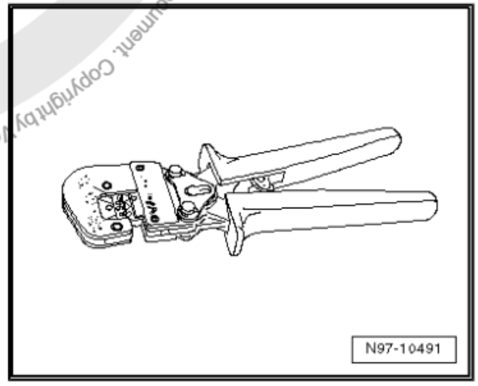
N97-10492

> **Caution**
>
> *In the retraction of the connection by pressure, it is essential to ensure that the hot air blower does not damage other cables, plastic parts or any other lining.*
>
> *Closely follow the instruction manual for the hot air blower.*

The Hot air blower - VAS 1978/14- is assemble together with the Adapter for the hot air blower - VAS 1978/15- to carry out retraction of the connection by pressure in order to prevent the entry of humidity.

The Hot air blower - VAS 1978/14- is part of the Harness repair set - VAS 1978- .

2.3.6 Crimping pliers - VAS 1978/1A-


N97-10491

The crimping pliers - VAS 1978/1A- or the base pliers for crimping jaw - VAS 1978/1-2- and adapter jaw 0.35-2.5 mm² - VAS 1978/1-1- , or the crimping pliers insertion element - VAS 1978/2A- are used to crimp connectors from the wiring harness repair kit.

Crimping of crimp connectors with the Crimping pliers - VAS 1978/1A- ⇒ page 122 .

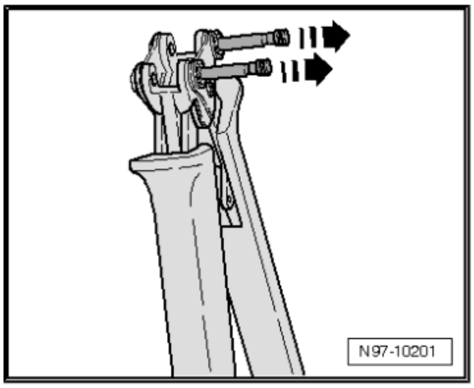
The following replacement heads can be acquired for the Base pliers for crimping jaw - VAS 1978/1-2- :

- 0.35 mm ^{2} - 2.5 mm ^{2} replacement head - VAS 1978/1-1-
- 4.0 mm ^{2} - 6.0 mm ^{2} replacement head - VAS 1978/2A-
- JPT contact replacement head - VAS 1978/9-1-

Along with the JPT contact replacement head - VAS 1978/9-1- , the crimping pliers for contact crimping are also used on individual cables to repair cross cable sections of up to 0.35 mm ^{2} ⇒ page 107 .

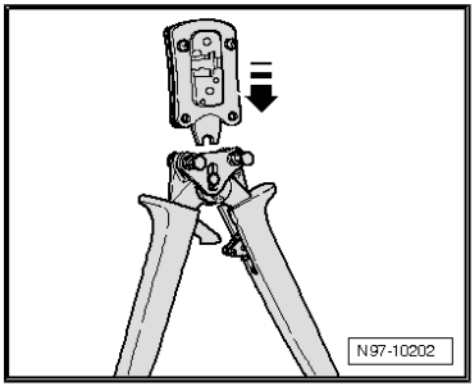
Replace the replacement head:

– Open the crimping pliers completely.

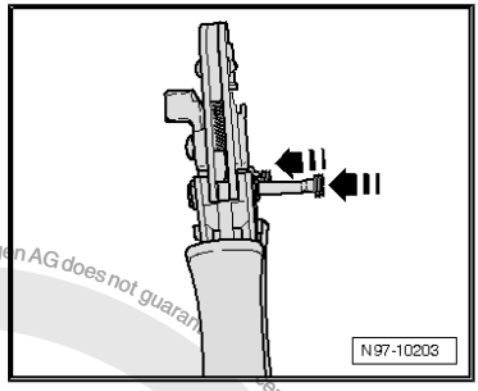

N97-10201

– Unlock both locking pins -arrows- of the body of the crimping pliers.

– Place the required replacement head over -arrow- the body of the crimping pliers.



– Lock the replacement head onto the body of the crimping pliers by pressing the pins -arrow-.



2.4 Harness repair

⇒ “2.4.1 Repairing airbag and seat belt pre-tensioning cables”, page 103

⇒ “2.4.2 Repairing CAN-Bus system cables”, page 106

⇒ “2.4.3 Replacing antenna cables”, page 106

⇒ “2.4.4 Repairs of electrical connectors 0.13 mm2/0.35 mm2/0.5 mm2 ”, page 107

⇒ “2.4.5 Repairs of cables with 10 mm2 or 16 mm2 with individual top connectors”, page 111

⇒ “2.4.6 Repairs of aluminium cables with 2.5 mm2, 4 mm2 or 6 mm2 with individual top connectors”, page 116

⇒ “2.4.7 Interruption in cables with a repaired section”, page 121

⇒ “2.4.8 Interruption in cables with two repaired sections”, page 122

Note

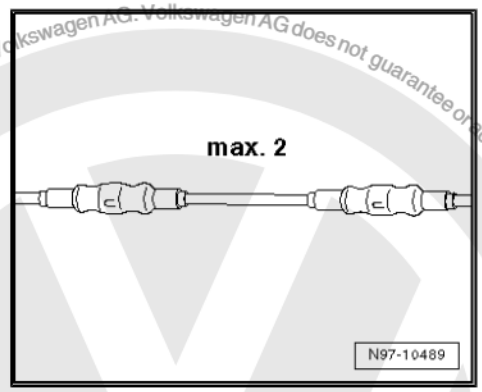
Pay attention to the notes regarding repair work on the electrical system
⇒ “2.1 General notes on repair work on the electrical system of the vehicle”, page 97 .

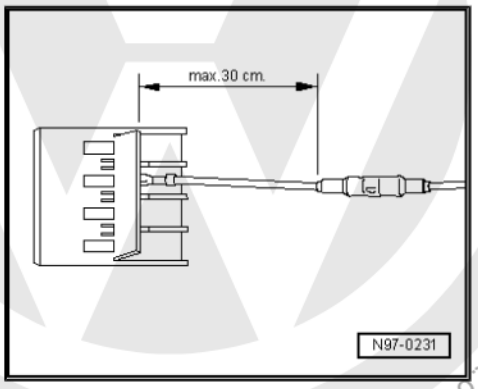
2.4.1 Repairing airbag and seat belt pre-tensioning cables

For supplementary repairs on airbag and seat belt pre-tensioning cables, observe the following instructions:

WARNING

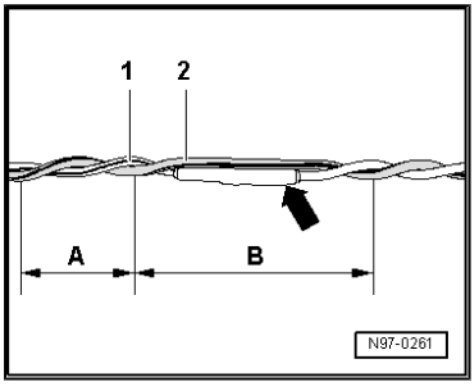
- *Badly execute repair work on the harnesses of airbag and seat belt pre-tensioning cables may cause faults in the passenger protection system.*
- *Repair work involving airbag and seat belt pre-tensioning cables should only be carried out with terminals, connectors and cables designed for this purpose ⇒ Electronic Parts Catalogue .*



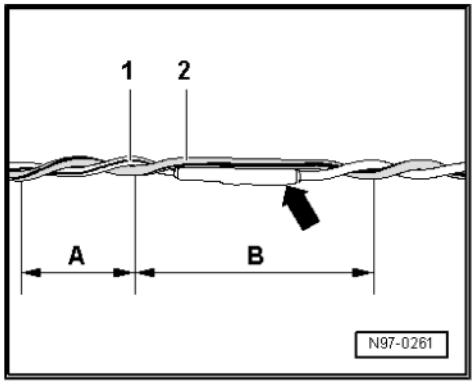


Note

- *Repair work involving airbag and seat belt pre-tensioning cables should only be carried out with the Harness repair set - VAS 1978- / Harness repair set - VAS 1978A- .*
- *Observe the stickers on the vehicle that indicate the parts with high voltage. In case of repairs, the residual voltage must be discharged ⇒ General body repairs, interior; Rep. gr. 69 ; Passenger protection .*
- *No more than two sections of the airbag and seat belt pre-tensioning cables should be repaired. Repaired sections increase the electric resistance of the cable, an may cause faults in the system's self-diagnosis.*
- *In the event of repair work on the airbag and seat belt pre-tensioning cables, the pressure connection should undergo retraction in order to avoid corrosion.*
- *Repairs to harnesses should only be carried out with yellow cables.*
- *Repairs to harnesses should not be reintegrated into the lining of the original harness of the vehicle. They should be identified with a yellow adhesive tape.*
- *These yellow cables and all locations identified with the yellow tape indicate previous repairs.*
- *Repair work around the airbag and seat belt pre-tensioners should be carried out at least 11.81 in from the next contact box. In conjunction with identifying the yellow tape, this procedure allows immediate verification of the areas to be repaired.*
- *The cables of the activation units (Airbags) have the twisting with the gap of 20 ± 5 mm as series. This gap is ensured in the serial manufacturing via normative part numbers for the pairs of cables, and it is vital to maintain it in the repair of the twisted cable length.*
- *In repair work, the cables in the activation units (airbags) should be of the same length. While stranding cables -1- and -2- it is essential to maintain the A = 20 ± 5 mm gap.*
- *There must not be any repair to the cable -arrow- that results in a length of more than B = 100 mm without the cables being stranded.*



2.4.2 Repairing CAN-Bus system cables



- With the CAB-Bus cable, a cable with two wires an no protection is used -1- and -2- with a transversal section area of 0.35 mm^2 or 0.5 mm^2.
- Colour codes of the CAN-Bus system cables:

CAN-High cable, activation	orange/black
CAN-High cable, Comfort system	orange/green
CAN-High cable, Infotainment	orange/purple
CAN-Low cable (all)	orange/brown

- Besides the repair cables with their respective transversal sections, the CAN-Bus system may be repaired with “green/yellow” or “white/yellow” stranded cables from the ⇒ Electronic Parts Catalogue “ETKA” .
- In repair work, the two CAN-Bus cables should be of the same length. When stranding cables -1- and -2- it is essential to maintain the A = 20 mm gap.
- There must not be any repair to the cable -arrow- that results in a length of more than B = 50 mm without the cables being stranded.
- Place yellow adhesive tape around the repaired sections so as to identify previously repaired sections.

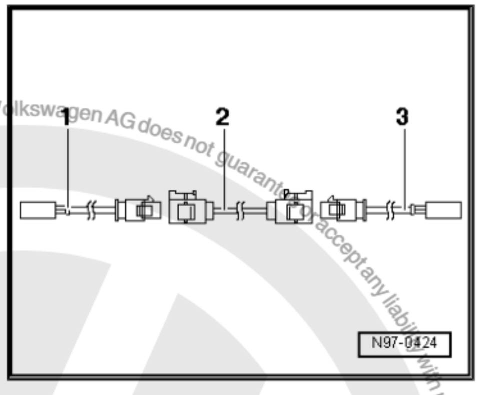
2.4.3 Replacing antenna cables

A new concept in repairs has been developed to repair antenna cables. Connection cables with differing lengths and different adapters are available as replacement parts to replace complete conventional antenna cables.

General description:

- Antenna cables must not be repaired. They should be replaced exclusively by connection cables and adapters belonging to the range of genuine replacement parts ⇒ Communication; Rep. gr. 91 ; Radio, telephone, navigation system .
- Replacement parts can be found listed in the ⇒ Electronic Parts Catalogue “ETKA” .
- The connector terminals of the antenna cables are available as replacement parts in one colour only. However, they may be used for all colours of connectors.
- The replacement of isolated antenna connectors is not allowed for in case of repair.
- The connection cables should be used from now on in all VW models, with all diameters of antenna cable.
- All adapters and connection cables are suitable for all transmission and reception signals.
- The repair concept may also be used for verification of later assembly.

General overview of antenna cable assembly:



Example: a broken radio antenna cable. The following cables are required to carry out the repair:

1 - Adaptation cable for connection to the radio; approx. length 30 cm.

2 - Connection cable, available in different lengths.

3 - Adaptation cable for connection to the antenna; approx. length 30 cm.

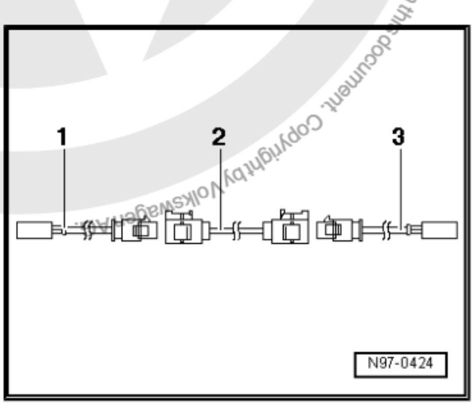
Assembly of a new antenna cable:

Note

Depending on the equipment in the vehicle, the total length of an antenna cable may be divided into partial sections by the antenna control units of the traffic information system or antenna amplifiers. Replace the damaged section only.

– Disconnect the damaged antenna cable connectors from their respective units.

– Determine the trajectory of the damaged antenna cable and measure the total length of the antenna cable to be installed in the vehicle.



The total length of the antenna cable depends on the length of the necessary antenna adaptation cables -1- and -3- , as well as the connection cable -2-.

– Subtract 60cm of the total determined length of the antenna cable, thus obtaining the necessary length for the connection cable -2-.

– Request the necessary adaptation cables -1- and -3- and the connection cable -2- with the length calculated for the replacement parts, according to the parts catalogue.

– Cut the cable connectors of the damaged antenna cable.

The remains of the damaged antenna cables will stay in the vehicle.

– Connect the adaptation cables -1- and -3- to the units of the vehicle.

– Install the connection cable -2- near the original position of the antenna cable of the vehicle.

Note

Antenna cables must not be obstructed or excessively stranded. Curvature must not exceed 50mm.

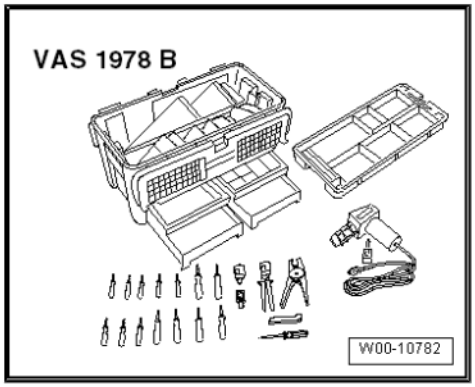
– Connect the connection cable -2- to the adaptation cables -1- and -3-.

– Check that the system works correctly.

2.4.4 Repairs of electrical connectors 0.13 mm^2/0.35 mm^2/0.5 mm^2

Special tools and workshop equipment required

- The Hot air blower - VAS 1978/14A- of the harness repair set - VAS 1978 B- .



- Crimping pliers (body) - VAS 1978/1-2- of the harness repair set - VAS 1978 B-
- Adapter jaw 0.13 - 0.5 mm² - VAS 1978/1-3-

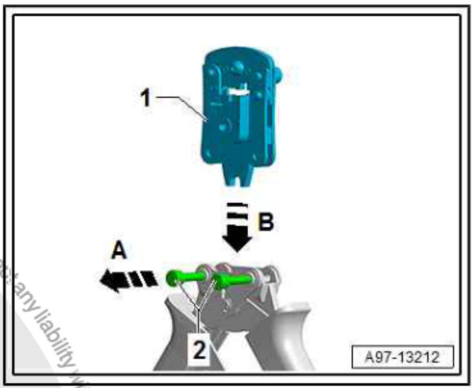
Note

Repair cables with cross-section of 0.35 mm² or 0.5 mm² are available for repairs.

Work sequence

– Install the interchangeable jaw 0.13 - 0.5 mm² - VAS 1978/1-3- -1- over the body of the crimping pliers (body) - VAS 1978/1-2- :

– Open the crimping pliers -VAS 1978/1-2- .



– Pull the safety pins -2- out until reaching the stop, in the -direction of arrow A-.
– Install the interchangeable jaw -VAS 1978/1-3- -1- in the -direction of arrow B- in the centre of the crimping pliers -VAS 1978/1-2- .
– Push the safety pins -2- back inward, until reaching the stop.
– Release the repair cable approximately 20 cm on both sides of the repair position.

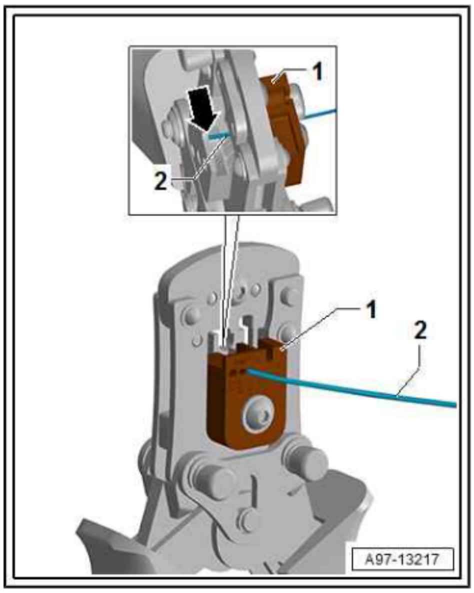
> ⚠ Caution
>
> *Risk of damages to electrical conductors.*
>
> ♦ *Carefully release coated wire harnesses*

– Remove the coating if necessary.
– Cut the damaged cable section using side cutting pliers.

Note

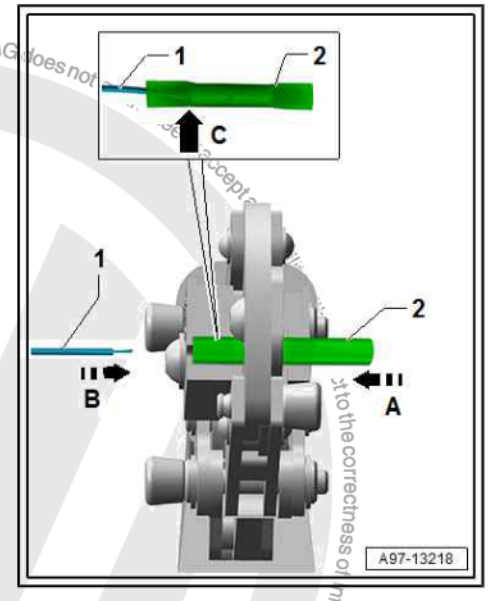
♦ *If a simple vehicle conductor is too short with a single direct seam on the top connector, after cutting the damaged wire section, insert two top connectors, a yellow repair cable with the same length of the damaged wire section that was removed.*

♦ *When repairing simple conductors with crimped/pressed contacts, place the yellow repair cable next to the damaged simple conductor and cut the required section.*

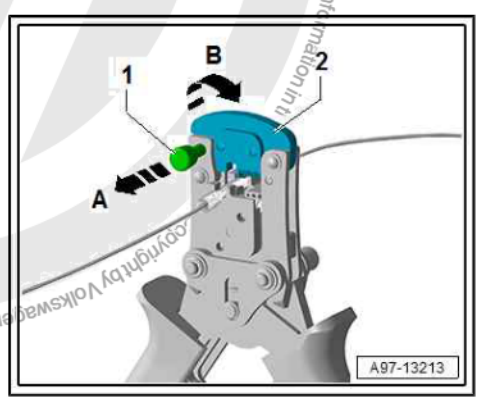


– Insert the end of the cable -2- until the stop -arrow- into the housing of the appropriate interchangeable jaw of the cross section -VAS 1978/1-3- -1-.
– Press and hold the crimping pliers.
– To remove the coat, pull the end of the cable -2- out of the interchangeable jaw -VAS 1978/1-3- -1-.
– Open the crimping pliers again.
• The insulation must have been cut and removed from the cable
• There must not be any remaining insulation in the open wire
• Wires must not be damaged
– Take a small transparent crimping connector from the harness repair set - VAS 1978 B- .
– In cables with cross section of 0.13 mm^2, additionally place a heat-shrink tube in one of the cables ⇒ Electronic Parts Catalogue (ETKA) .

– Insert the crimping connector -2- until the stop, in the -direction of arrow A- onto the interchangeable crimping jaw - VAS 1978/1-3- .
– Insert the uncoated cable end -1- in the -direction of arrow B- into the crimping connector -2-.
• All individual wires must be inserted into the crimping connector -2-
• Cable insulation -arrow C- cannot be crimped along with the connector.
– Press the crimping pliers completely and open again.
– Remove the cable with crimped connector.
– Repeat the cable crimping with top connector on the other side, as described above.

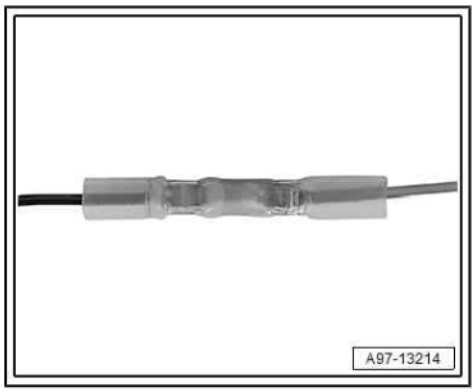


– Remove the safety pin -1- until reaching the stop, in the -direction of arrow A-.
– Turn the upper section of the interchangeable jaw -VAS 1978/1-3- -2- in the -direction of arrow B-.
– Remove the crimped top connector.



Correct crimping result

– After crimping, the crimped connector must be shrunk with the hot air blower to isolate from humidity.
• In cables with cross section of 0.13 mm^2, also shrink the heat-shrink tube on the seam to ensure complete insulation.

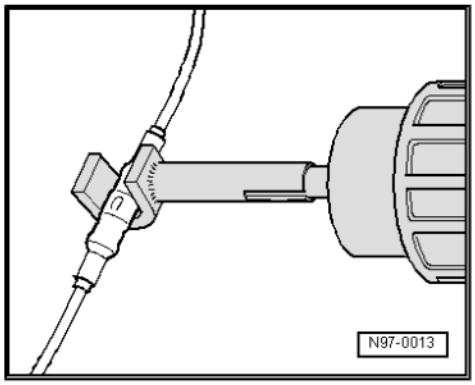


– Install the Hot air blower adapter - VAS 1978/15A- on the Hot air blower - VAS 1978/14A.- .

Caution

Risk of damages to electrical conductors.

- *When shrinking the heat-shrink tube, ensure no other cable, plastic or insulation materials are damaged by the hot air blower.*
- *Closely follow the instruction manual for the hot air blower!*

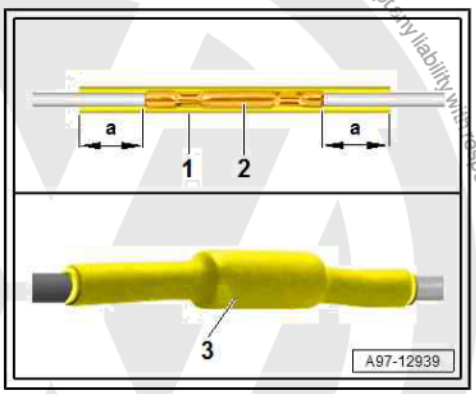


– In cables with cross section of 0.13 mm², centre the heat-shrink tube -1- over the crimped top connector -2- by feeling the outlines of the seam.

• Measurement -a- must be approximately equal on both sides.

– Heat the heat-shrink tube with the hot air blower longitudinally, from the center out, until it is completely sealed and the adhesive comes out in the edges.

• The repaired area must look like this -3-.

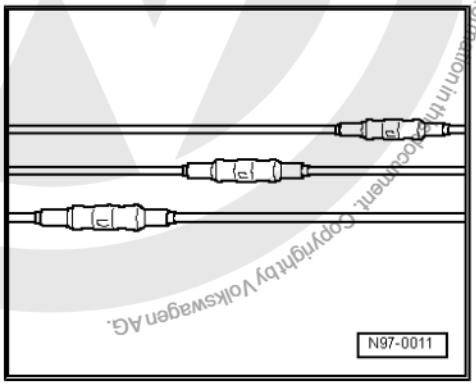


Note

♦ *If multiple cables must be repaired, crimped connectors must not be different on each side. Slightly displace the crimping connectors to ensure the wiring harness perimeter is not too high.*

♦ *If the repair position was previously shielded, the position must be re-shielded after repair, using yellow masking film.*

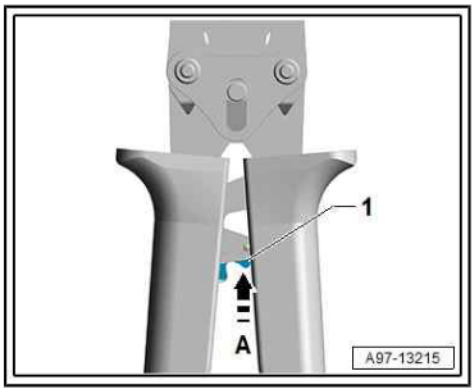
♦ *Secure the repaired wiring harness, if necessary, with a cable connector, to avoid noises while druving.*



Early unlocking

– Press the unlocking lever -1- up, in the -direction of the arrow-.

– At the same time, slightly press the crimping pliers and open again.



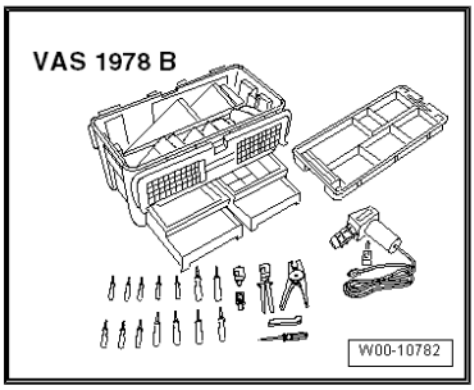
Caution

♦ *Do not use top connectors after early unlocking.*

2.4.5 Repairs of cables with 10 mm² or 16 mm² with individual top connectors

Special tools and workshop equipment required

♦ The Hot air blower - VAS 1978/14A- of the harness repair set - VAS 1978 B- .



♦ The Hot air blower adapter - VAS 1978/15A- of the harness repair set - VAS 1978 B- .

- Harness repair set - VAS 631 003-

Note

- *Repair cables (per meter) with cross-section of 10 mm² or 16 mm² are available for repairs.*
- *Additionally, individual repair cables with crimped/pressed contacts are also available for repairs.*

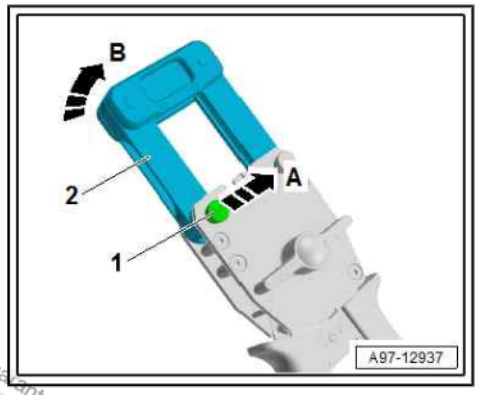
Work sequence

– Install the crimping frame and the crimping puncture appropriate to the cable's cross section onto the crimping pliers, as described below:

– Open the crimping pliers of the harness repair set - VAS 631 003- .

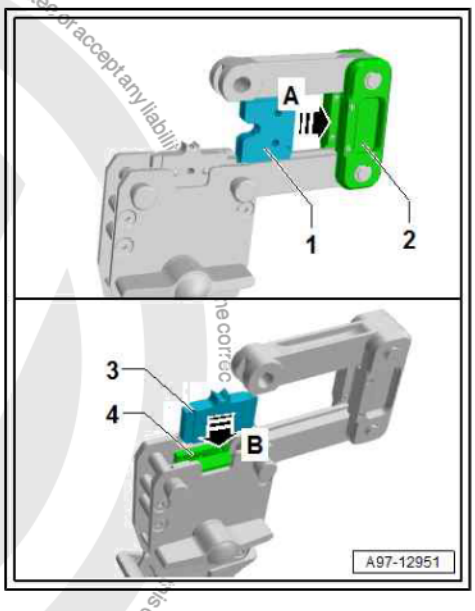
– Remove the safety pin -1- until reaching the stop, in the -direction of arrow A-.

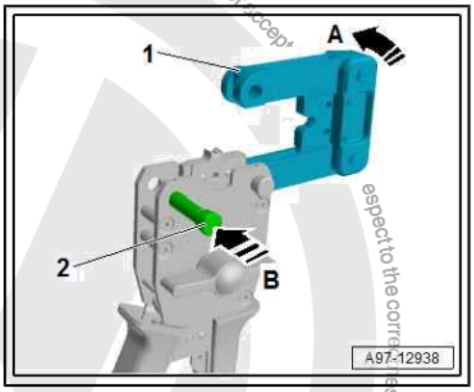
– Open the adapter -2- in the -direction of arrow B-.



– Insert the crimping puncture -1- until audibly secured in the housing -2- of the adapter -arrow A-.

– Insert the crimping frame -3- until audibly secured in the housing -4- of the crimping pliers -arrow B-.





– Close the adapter -1- in the -direction of arrow A-.
– Insert the safety clip -2- in the -direction of arrow B- until reaching the stop.
– Release the repair cable approximately 20 cm on both sides of the repair position.

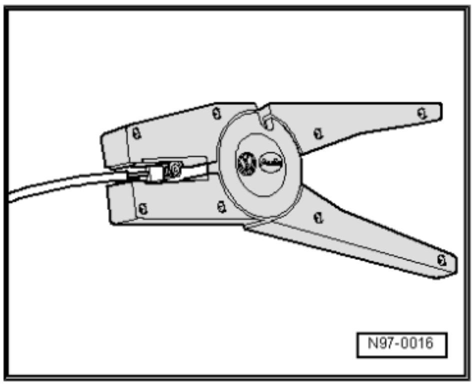
> ⚠ Caution
>
> *Risk of damages to electrical conductors.*
>
> ♦ *Carefully release shielded wire harnesses.*

– If necessary, release the wiring harness shield using a knife.
– Cut and remove the damaged cable section using the cable scissors of the harness repair set - VAS 631 003- .

ℹ Note

♦ *If the two ends of the simple vehicle conductor are too short to repair with a single top connector, due to the cut out damaged conductor section, install a piece of yellow repair cable with the same length and with two top connectors.*

♦ *When repairing simple conductors with crimped/pressed contacts, place the yellow repair cable next to the damaged simple conductor and cut the required section.*



– Adjust the moving stop of the pliers to remove the coating of cables of the harness repair set - VAS 631 003- based on the length of the cables to be exposed.

♦ 10 mm^2 cables: 14 mm

♦ 16 mm^2 cables: 16.5 mm

– Insert the end of the front cable onto the pliers, until reaching the stop, and close the pliers completely.
– Open the pliers again and remove the coat from the end of the cable.

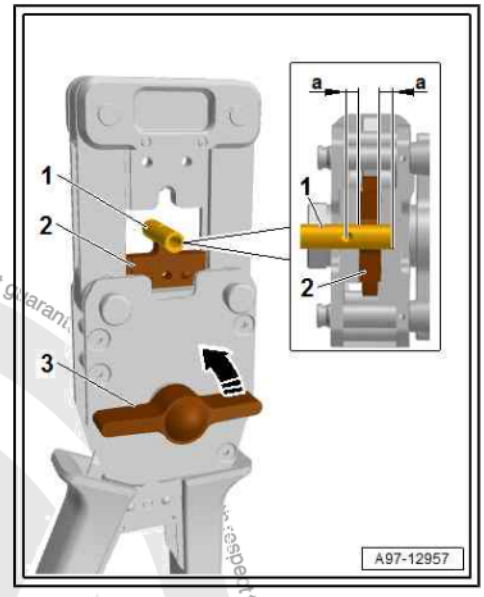
• The insulation must have been cut and removed from the cable
• There must not be any remaining insulation in the open wire
• Wires must not be damaged

– For repairs, use a suitable top connector and heat-shrink tubes of the harness repair set - VAS 631 003- .
– Insert the heat-shrink tube in one of the cables.

– Place the top connector -1- with the first crimping point on the centre of the crimping frame -2-.

• Measurement -a- must be identical on both sides

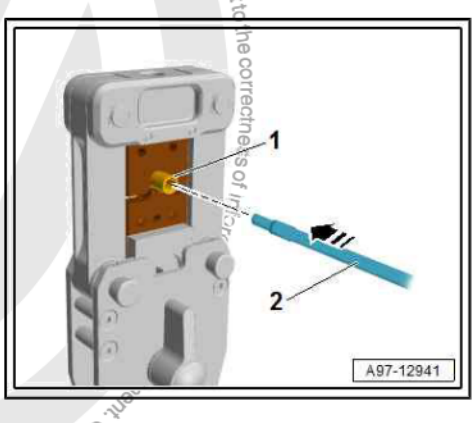
– Turn the quick-insert lever -3- anti-clockwise -arrow- until the top connector -1- is secured in place.



– Insert the cable -2- with the exposed end until the stop of the top connector -1- -arrow-.

• Each individual wire must have been inserted in the top connector

– Close and open the crimping pliers repeatedly until the crimping frame moves down into starting position.



Note

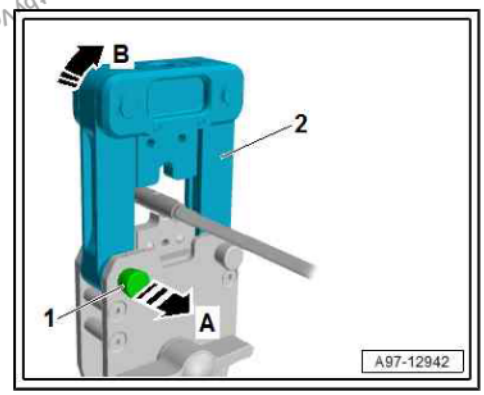
Cable insulation cannot be crimped along with the connector.

– Repeat the cable crimping with top connector on the other side, as described above.

– Remove the safety clip in the -direction of arrow A- until reaching the stop.

– Open the adapter in the -direction of arrow B-.

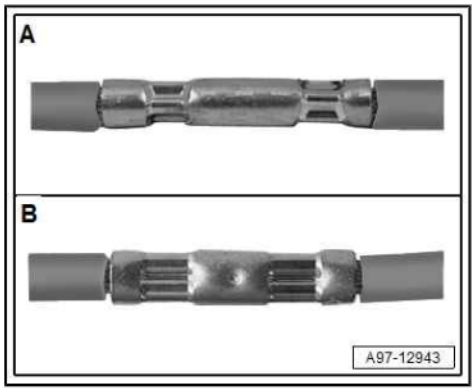
– Remove the crimped top connector.



Correct crimping result

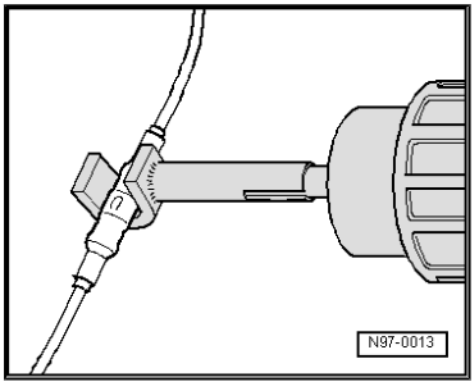
A - 10 mm^2, star crimping

B - 16 mm^2, B crimping



After crimping, the heat-shrink tube must be shrunk over the top connector with the hot air blower to isolate from humidity.

– Place the Hot air blower adapter - VAS 1978/15A- over the Hot air blower - VAS 1978/14A- .

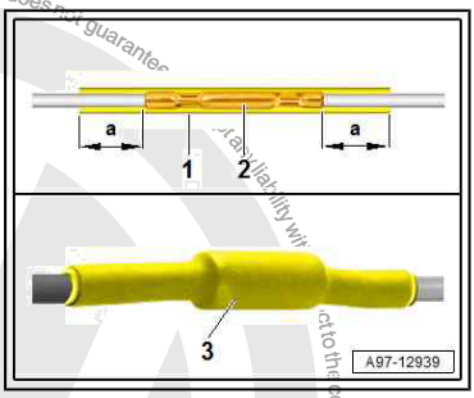


Caution

Risk of damages to surrounding components.

- *When shrinking the heat-shrink tube, ensure no other cable, plastic or insulation materials are damaged by the hot air blower.*
- *Closely follow the instruction manual for the hot air blower!*

– Place the heat-shrink tube -1- on the centre, above the top connector -2- by feeling the outlines.



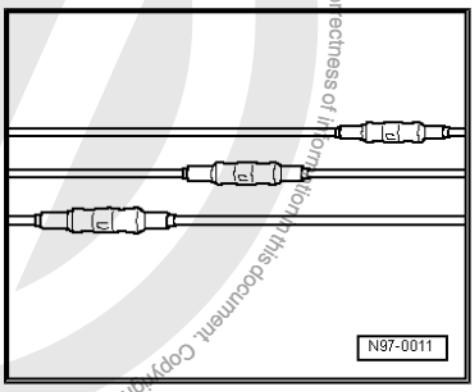
- Measurement -a- must be approximately identical on both sides

– Heat the heat-shrink tube with the hot air blower longitudinally, from the centre out, until it is completely sealed and the adhesive comes out in the edges.

- The repaired area must look like this -3-.

Note

- *If multiple cables must be repaired, top connectors must not be different on each side. Slightly displace the top connectors to ensure the wiring harness perimeter is not too high.*
- *If the repair position was previously shielded, the position must be re-shielded after repair, using yellow masking film.*
- *Secure the repaired wiring harness, if necessary, with a cable connector, to avoid noises while druving.*

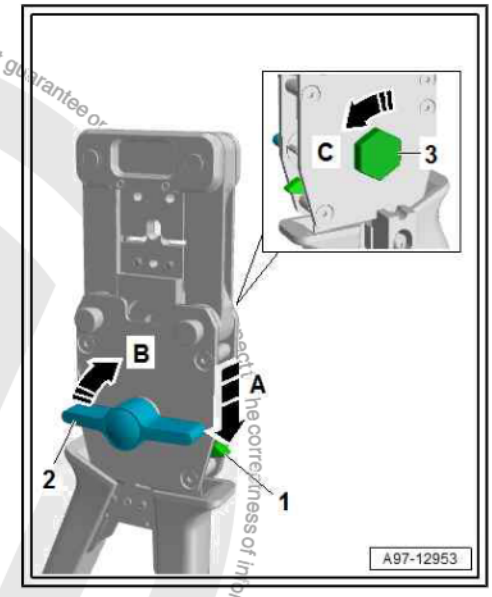


Early unlocking

– Press the lever -1- down -arrow A-.
– Turn the quick-insert lever -2- anti-clockwise -arrow B- until the crimping frame moves into starting position.

When it is not possible to manually unlock:

– Press the lever -1- down -arrow A-.
– Insert the wrench of the harness repair set - VAS 631 003- into the bolt -3- on the rear side.
– Turn the wrench anti-clockwise -arrow C- until the crimping frame moves into starting position.



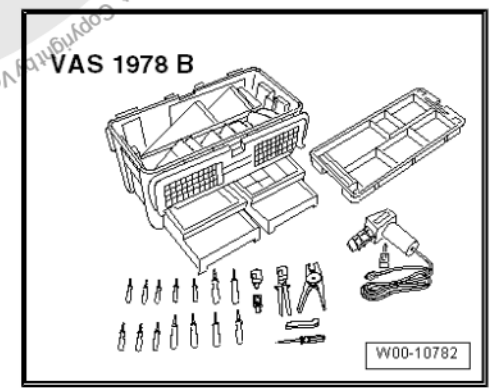
Caution

Do not use top connectors after early unlocking.

2.4.6 Repairs of aluminium cables with 2.5 mm^2, 4 mm^2 or 6 mm^2 with individual top connectors

Special tools and workshop equipment required

- The Hot air blower - VAS 1978/14A- of the harness repair set - VAS 1978 B- .



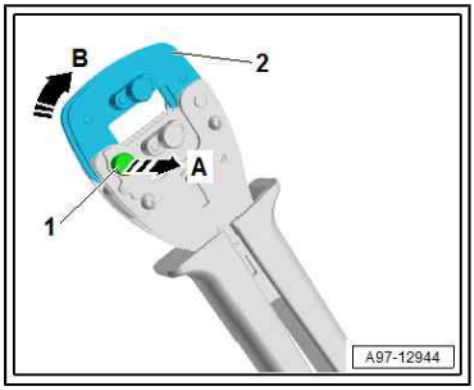
- The Hot air blower adapter - VAS 1978/15A- of the harness repair set - VAS 1978 B- .
- Harness repair set - VAS 631 001-

Note

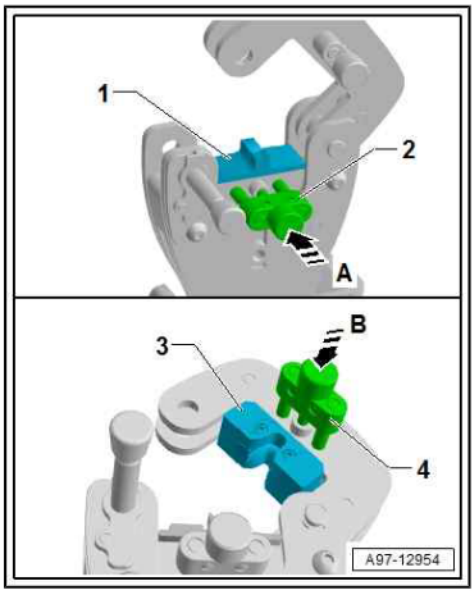
- *Copper repair cables (per meter) with cross-section of 2.5 mm^2, 4 mm^2 or 6 mm^2 are available for repairs.*
- *Additionally, individual copper repair cables with crimped/ pressed contacts are also available for repairs.*

Work sequence

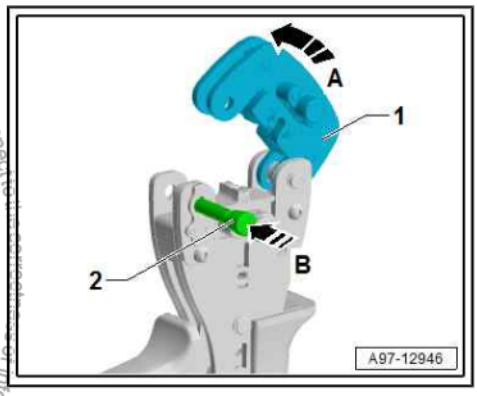
- Install the crimping frame and the crimping puncture with contact guide and contact lock appropriate to the cable's cross section onto the crimping pliers, as described below:
- Open the crimping pliers of the harness repair set - VAS 631 001- .
- Remove the safety pin -1- until reaching the stop, in the -direction of arrow A-.
- Open the housing -2- in the -direction of arrow B-.



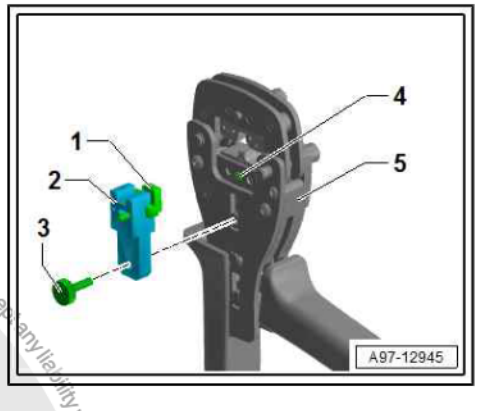
- Place the crimping frame -1- on the crimping pliers, aligning the frame -1- to the front of the pliers.
- Secure the crimping frame with the pins -2- -arrow A- and manually tighten the knurled bolt.
- Place the crimping puncture -3- into the housing based on the crimping frame.
- Secure the crimping puncture with the pins -4- -arrow B- and manually tighten the knurled bolt.



- Close the adapter -1- in the -direction of arrow A-.
- Insert the safety clip -2- in the -direction of arrow B- until reaching the stop.



– Place the contact lock -1- into the contact guide -2-.
– Place the contact guide with the contact lock into the crimping pliers -5-, inserting the hole in the contact guide -2- over the knurled bolt -4-.
– Turn the knurled bolt -3- and tighten manually.
– Release the repair cable approximately 20 cm on both sides of the repair position.

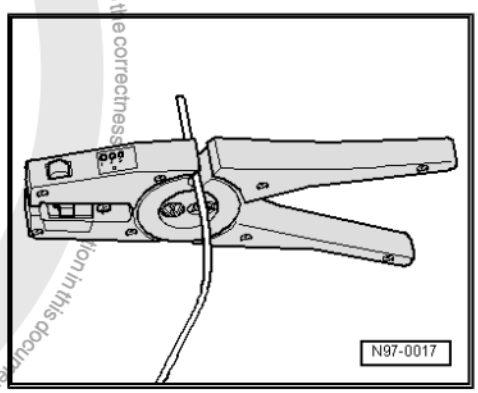


Caution

Risk of damages to electrical conductors.

- *Carefully release shielded wire harnesses.*

– If necessary, release the wiring harness shield using a knife.
– Cut and remove the damaged cable section using the wire stripper of the harness repair set - VAS 631 001- .

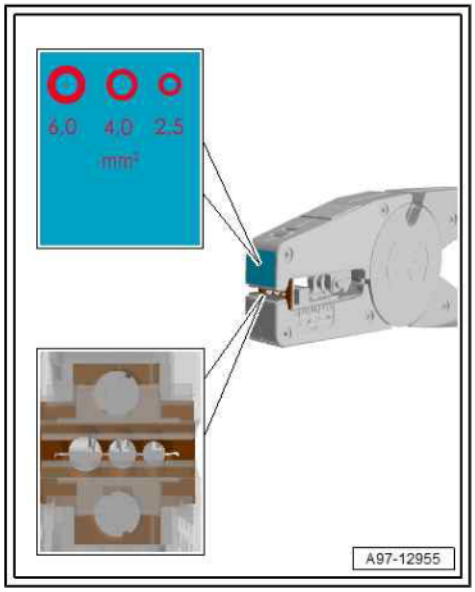


Note

If the two ends of the simple vehicle conductor are too short to repair with a single top connector, due to the cut out damaged conductor section, install a piece of yellow copper repair cable with the same length and with two top connectors.

– Insert the end of the cable on the front until the stop of the proper housing based on the cable intersection area onto the pliers.
– Press the pliers completely.
– Open the pliers again and remove the coat from the end of the cable.
- The insulation must have been cut and removed from the cable
- There must not be any remaining insulation in the open wire
- Wires must not be damaged

– For repairs, use a suitable top connector with heat-shrink tube of the harness repair set - VAS 631 001- .
– Insert the heat-shrink tube in one of the cables.

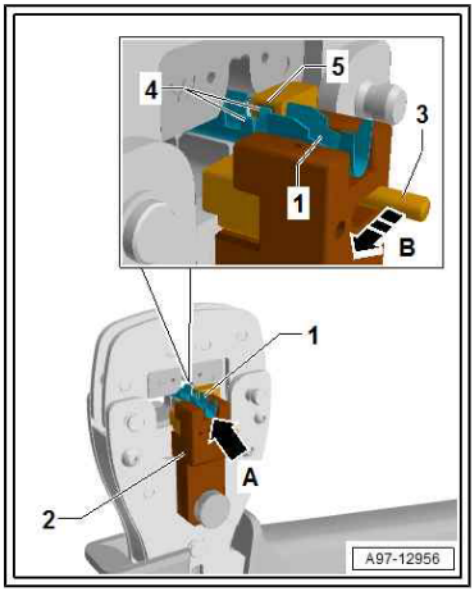


– Place the top connector -1- into the contact guide -2-.

• The top connector -1- must close aligned with the contact guide -2- -arrow A-

– Insert the contact lock -3- until the stop, in the -direction of arrow B-, securing the top connector -1-.

• The bumps -4- in the top connector -1- must fit onto the grooves -5- of the contact lock -3-

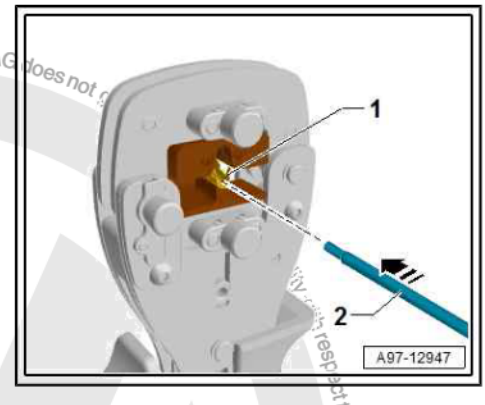


– Insert the cable -2- with the exposed end until the stop of the top connector -1- -arrow-.

• Each individual wire must have been inserted in the top connector

• The insulation end must close completely on the front insulation crimping corner.

– Close the crimping pliers completely until they open automatically.

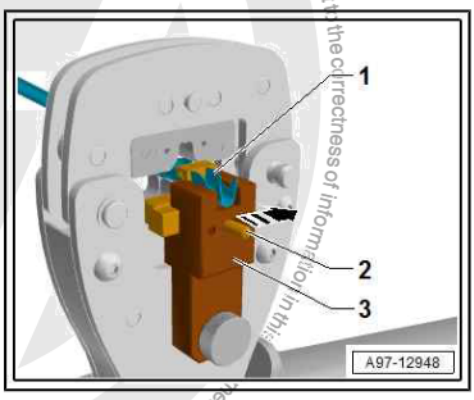


– Insert the contact lock -2- until reaching the stop, in the -direction of the arrow-.

– Remove the top connector -1- from the contact guide -3-.

– Turn the crimping pliers for 2nd crimping.

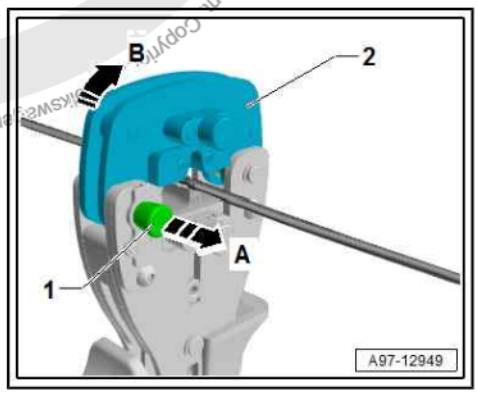
– Repeat the cable crimping with top connector on the other side, as described above.



– Remove the safety pin -1- in the -direction of arrow A- until the stop.

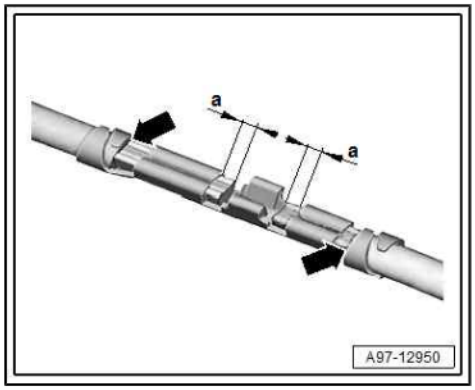
– Open the housing -2- in the -direction of arrow B-.

– Remove the crimped top connector.



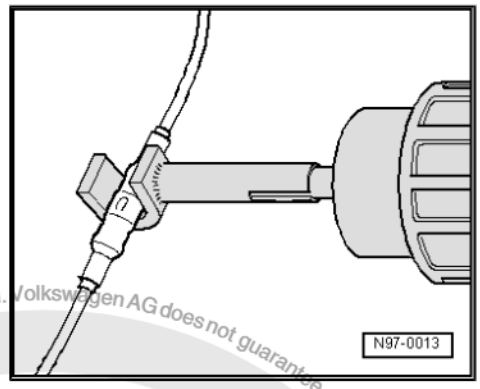
Correct crimping result

- The cable end must not exceed 0.1 mm … 1.0 mm on the front side of the wire crimping, measurement -a-
- The insulation end must not be crimped within the wire crimping
- The insulation end must close completely on the front insulation crimping corner, -arrows-



After crimping, the heat-shrink tube must be shrunk over the top connector with the hot air blower to isolate from humidity.

– Place the Hot air blower adapter - VAS 1978/15A- over the Hot air blower - VAS 1978/14A- .



Caution

Risk of damages to surrounding components.

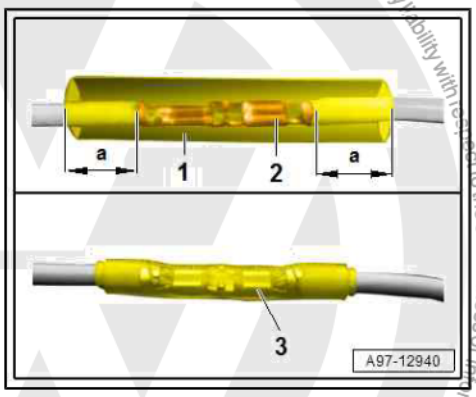
- *When shrinking the heat-shrink tube, ensure no other cable, plastic or insulation materials are damaged by the hot air blower.*
- *Closely follow the instruction manual for the hot air blower!*

– Place the heat-shrink tube -1- on the centre, above the top connector -2-.

- Measurement -a- must be approximately identical on both sides

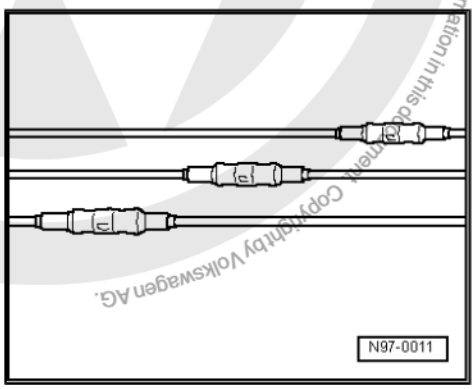
– Heat the heat-shrink tube with the hot air blower longitudinally, from the centre out, until it is completely sealed and the adhesive comes out in the edges.

- The repaired area must look like this -3-.



Note

- *If multiple cables must be repaired, top connectors must not be different on each side. Slightly displace the top connectors to ensure the wiring harness perimeter is not too high.*
- *If the repair position was previously shielded, the position must be re-shielded after repair, using yellow masking film.*
- *Secure the repaired wiring harness, if necessary, with a cable connector, to avoid noises while druving.*

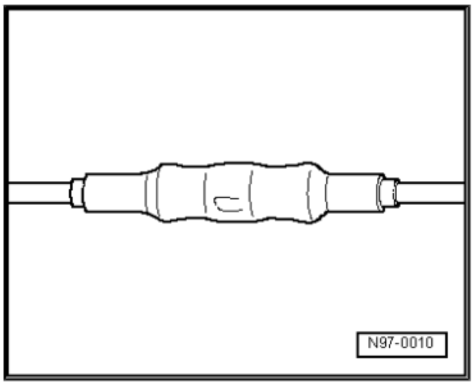


2.4.7 Interruption in cables with a repaired section

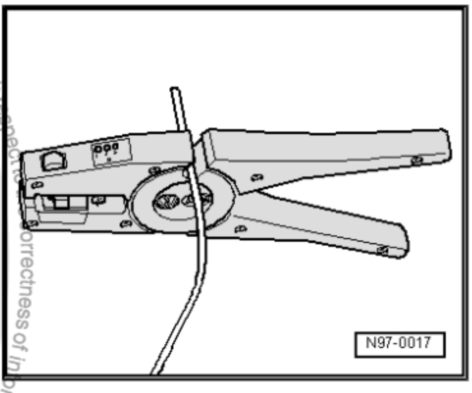
Repaired section with a pressure connection.

– Release the cable to be repaired (approx. 20 cm on both sides of the section to be repaired).

– If necessary, remove the cable lining with a penknife.



– Cut out the damaged section of the original cable, with Cable stripping pliers - VAS 1978/3- .

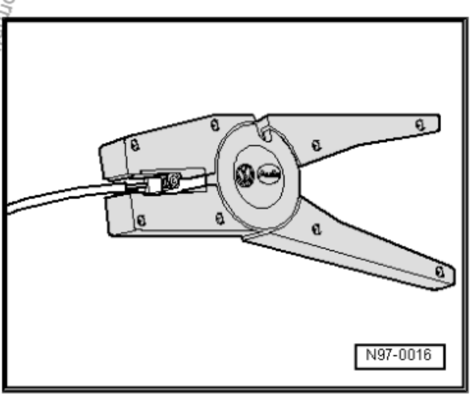


Note

If the two ends of the original simple cable do not have sufficient length to execute the repair with an individual pressure connection after they are cut, use a repair cable with the necessary length with two pressure connections *⇒ page 122* *.*

– Strip 6 or 7 mm from the ends with the Cable stripping pliers - VAS 1978/3- .

– Insert the pressure connection into both stripped ends of the original simple cable and compress with the Cleaving pliers - VAS 1978/1- .



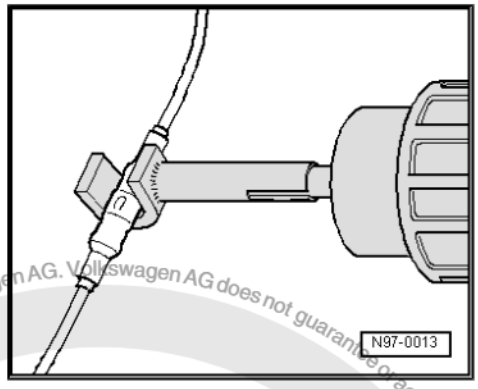
Note

- *The correct compression cavity must be used for the corresponding pressure connection* *⇒ page 100* *.*
- *The cable lining must not be compressed.*

After compression, carry out retraction of the pressure connection with the Hot air blower - VAS 1978/14- to prevent entry of humidity.

– Assemble the Hot air blower adapter - VAS 1978/15- on the Hot air blower - VAS 1978/14- .

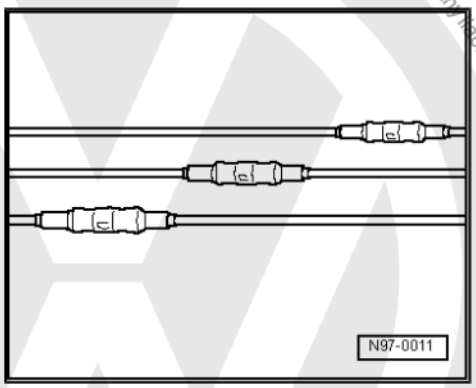
– Heat the pressure connection with the Hot air blower - VAS 1978/14- in the lengthwise direction, from the centre to the ends, until it is completely sealed and glue starts to come out of the ends.



> **Caution**
>
> *In the retraction of the connection by pressure, it is essential to ensure that the Hot air blower - VAS 1978/14- does not damage other cables, plastic parts or any other lining.*
>
> *Closely follow the instruction manual for the Hot air blower - VAS 1978/14- .*

Note

- *In the event that more than one cable needs repairing, ensure that the pressure connections are not placed together. In order to prevent the section of cables from occupying too much space, position the pressure connection slightly away.*
- *In the event that the repaired section is warped, rewrap the location with yellow adhesive after repairs have been carried out.*
- *If necessary, secure the repaired cables with a clamp, this avoiding the generation of any noise when the vehicle is later driven.*

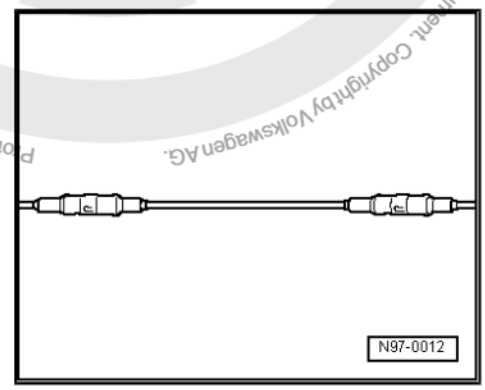


2.4.8 Interruption in cables with two repaired sections

Repair section in the middle of the cable.

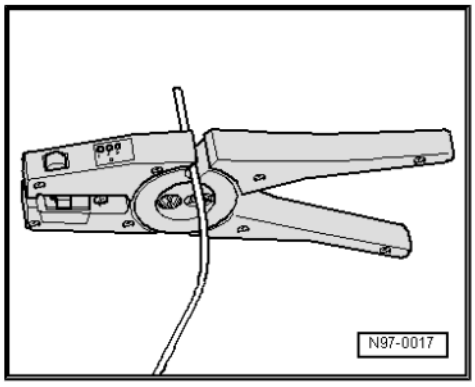
– Release the cable to be repaired (approx. 20 cm on both sides of the section to be repaired).

– If necessary, remove the cable lining with a penknife.

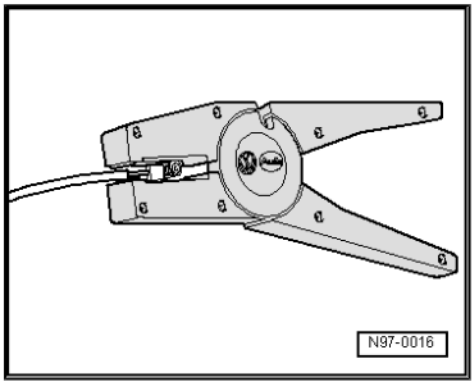


– Place the yellow repair cable alongside the damaged cable and cut the necessary length from the repair cable with the Cable stripping pliers - VAS 1978/3- .

– Cut out the damaged section of the original simple cable.



– Strip 6 or 7 mm from the ends with the Cable stripping pliers - VAS 1978/3- .
– Apply one of the ends of the pressure connection to the original simple cable and the other to the repair cable.
– Compress the two ends of the pressure connection cable with the Cleaving pliers - VAS 1978/1- .
– Repeat this operation at the other end of the repair cable.

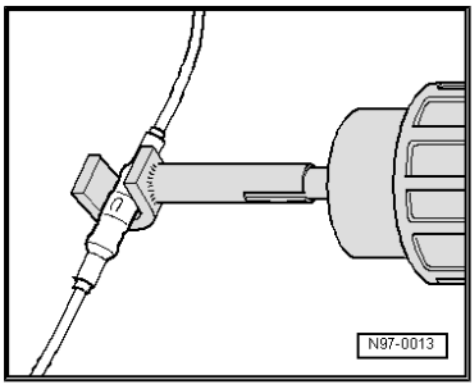


Note

- *The correct compression cavity must be used for the corresponding pressure connection ⇒ page 100 .*
- *The cable lining must not be compressed.*

After compression, carry out retraction of the pressure connection with a hot air blower in order to prevent entry of humidity.

– Assemble the Hot air blower adapter - VAS 1978/15- on the Hot air blower - VAS 1978/14- .
– Heat the pressure connection in the lengthwise direction, from the centre to the ends, until it is completely sealed and glue starts to come out of the ends.



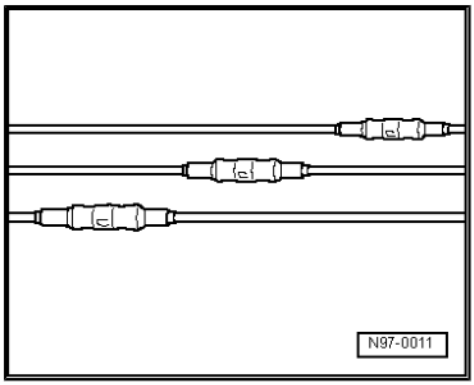
Caution

In the retraction of the connection by pressure, it is essential to ensure that the hot air blower does not damage other cables, plastic parts or any other lining.

Read the instruction manual for the hot air blower carefully!

Note

- *In the event that more than one cable needs repairing, ensure that the pressure connections are not placed together. In order to prevent the section of cables from occupying too much space, position the pressure connection slightly away.*
- *In the event that the repaired section is warped, rewrap the location with yellow adhesive after repairs have been carried out.*
- *If necessary, secure the repaired cables with a clamp, this avoiding the generation of any noise when the vehicle is later driven.*



2.5 Fibre optic cable repairs

⇒ “2.5.1 Fibre optic cable - prepare ”, page 124

⇒ “2.5.2 Fibre optic cable of the the cable set connector - separate”, page 130

The exact faulty position is very difficult to find. Damaged fibre optic cables must be replaced, seating the new cables parallel to the damaged fibre optic cable.

Note

- *Through the points of the vehicle diagnostic test equipment menu "Assisted fault identification" or "Assisted functions", it is possible to determine between which components the fibre optic cable is damaged.*
- *Previously repaired fibre optic cables are identified in "yellow".*

Procedure:

– Select "Assisted fault identification" or "Assisted functions" ⇒ Vehicle diagnostic tester on the vehicle diagnostics testing device.

– Fibre optic cable - prepare ⇒ page 124

Caution

Fibre optic cables must not be excessively bent. The bending radius must be under 25 mm.

Fibre optic cables must not be seated over sharp edges.

The ends of fibre optic cables must not be contaminated or touched with bare fingers.

Fibre optic cables must not be heated.

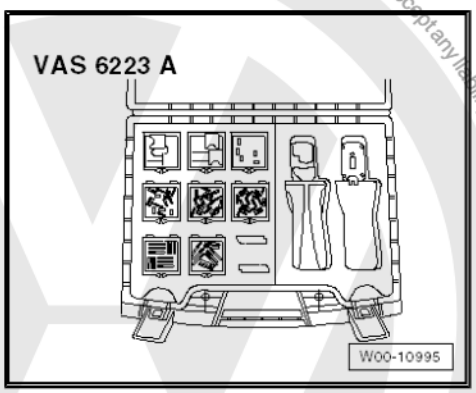
Intertwining two fibre optic cables or a fibre optic cable and a copper cable is not allowed.

Protect the connector and the connection cable against dust. Use protection covers.

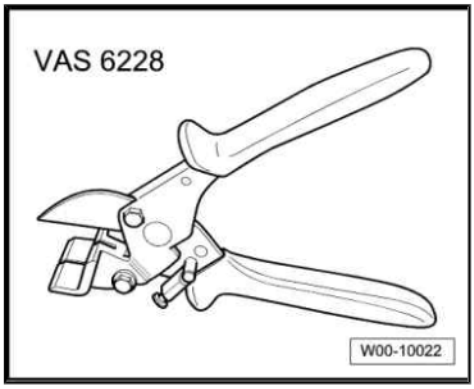
2.5.1 Fibre optic cable - prepare

Special tools and workshop equipment required

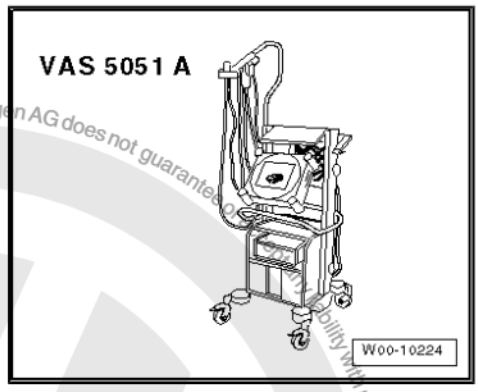
- Repair set - fibre optic - VAS 6223A-



- Plastic and rubber line cutting pliers - VAS 6228-



- Vehicle diagnostic tester



Caution

Fibre optic cables must not be excessively bent. The bending radius must be under 25 mm.

Fibre optic cables must not be seated over sharp edges.

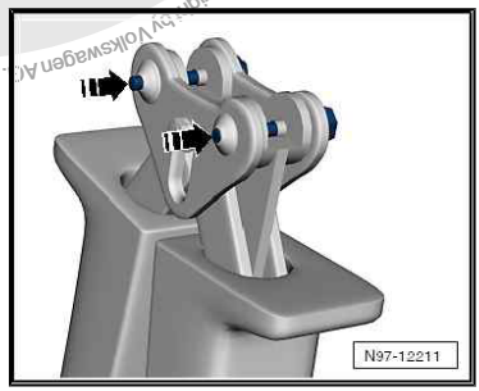
The ends of fibre optic cables must not be contaminated or touched with bare fingers.

Fibre optic cables must not be heated.

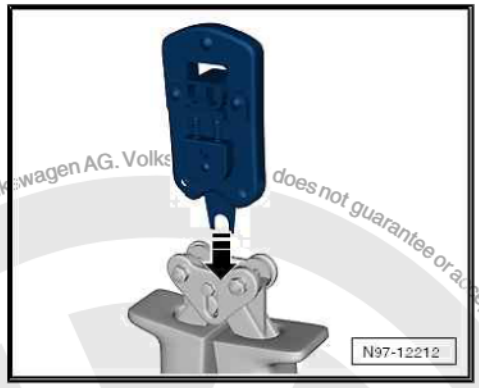
Intertwining two fibre optic cables or a fibre optic cable and a copper cable is not allowed.

Protect the connector and the connection cable against dust. Use protection covers.

Install the tool head on the fibre optic cable pliers - VAS 6223/1- .

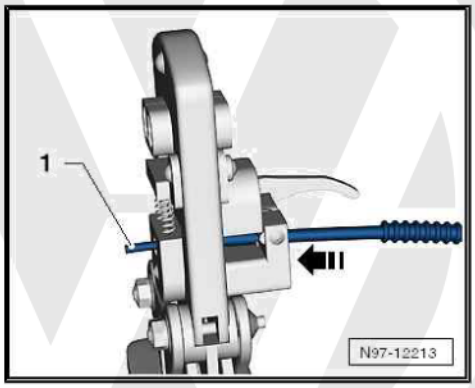


– Press the safety pins -arrows- to remove.
– Place the tool head -arrow- and remove the safety pins.



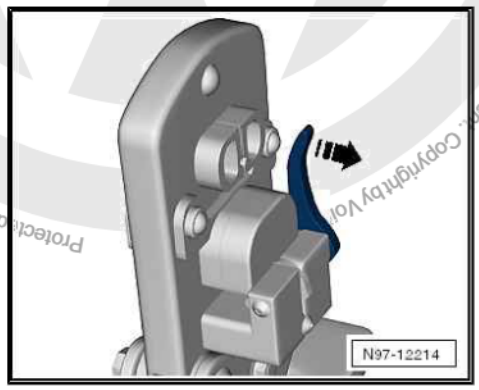
Shorten the fibre optic cable.

– Determine the required length of the fibre optic cable.
– Open the fibre optic cable pliers and place the fibre optic cable -1- on the shortening housing.
– Close the fibre optic cable pliers to shorten the cable.

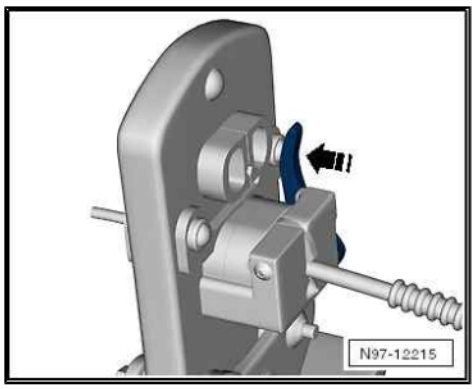


Stripping

– Open the fibre optic cable pliers - VAS 6223/1- .
– Place the stripping lever into lower position -arrow-.
– Insert the fibre optic cable on the stripping housing.
• The fibre optic cable must coincide precisely with the rear section of the cutting pliers.



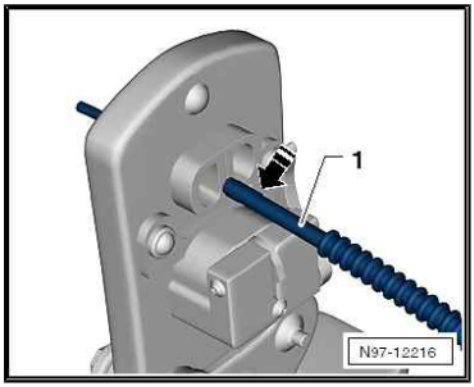
– Close and hold the fibre optic cable pliers until the fixed stop.
– Turn the stripping lever up -arrow- and remove the fibre optic cable.



Precision cutting (create frontal optic surface).

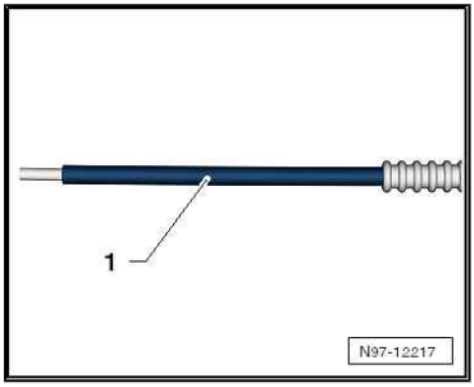
– Push the fibre optic cable -1- onto the cutting housing.

• The insulation must touch the cutting station stop.



– Close the fibre optic cable pliers - VAS 6223/1- and remove the cable.

– Visual inspection of the cable -1-, checking if the cable was cut correctly and if there are no chips on the front surface.

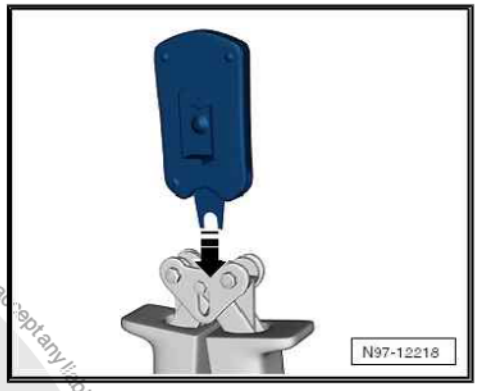


Note

♦ *Only place the fibre optic cable over clean surfaces/bases or hold the cable.*

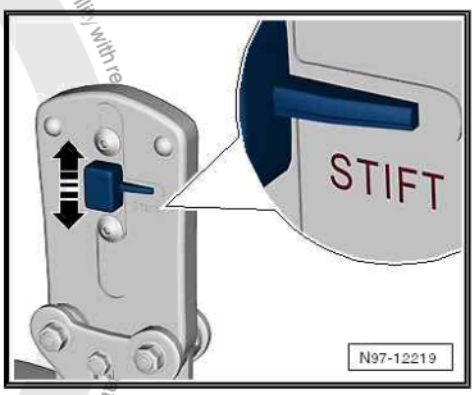
♦ *Use protection covers if there is a risk of contamination of the front surface of the fibre optic cable.*

Install the tin pin contact on the fibre optic cable.

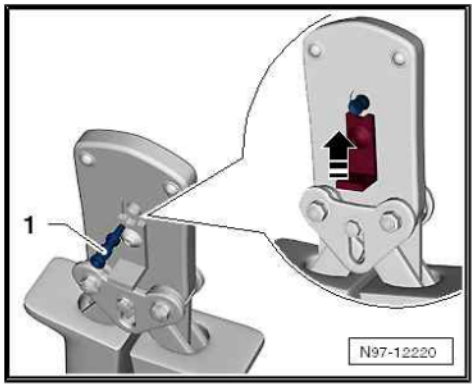


– Replace the tool head -arrow-.

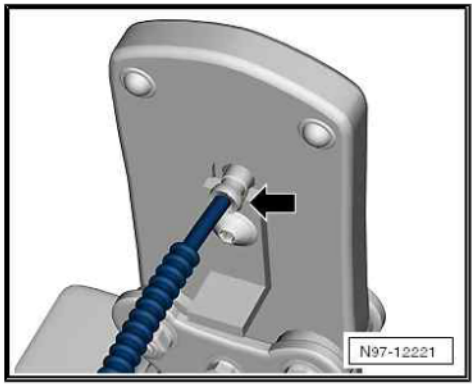
– Move the lock in the fibre optic cable pliers -arrow- in a way that the lettering “Stift” is visible.



– Insert a tin pin contact -1- into the housing.
– Close the safety lever in the fibre optic cable pliers -arrow-.



– Insert the fibre optic cable on the tin pin contact -arrow- until the dampened stop and close the fibre optic cable pliers .
– Open the fibre optic cable pliers and remove the fibre optic cable with tin pin contact.

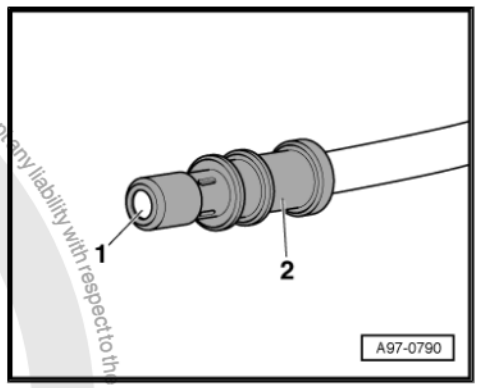


Caution

Fibre optic cables must not be excessively bent (minimum bending radius of 25 mm).

– Check if the tin pin contact is properly seated -2- onto the fibre optic cable -1-.

- All 4 crimping points must be visible in the tin connection pin.
- The tin pin contact cannot be manually removed from the fibre optic cable.
- The front surface of the fibre optic cable is located 0.01 ... 0.1 mm behind the tin pin contact (visual inspection).



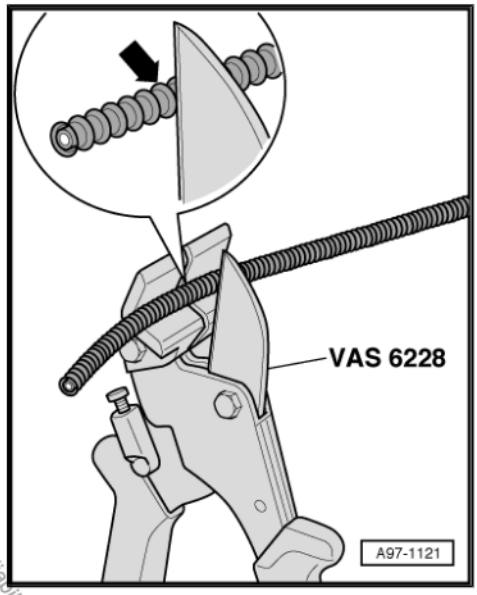
Note

- *Fitting couplings are available to connect fibre optic cables ⇒ Electronic Parts Catalogue .*
- *Install the new fibre optic cable in the cable set connector ⇒ page 130 .*

Install the corrugated line on the fibre optic cable.

– Cut the corrugated line to the appropriate length.

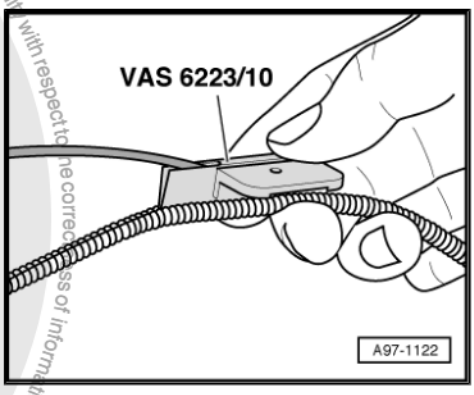
- To cut the line, use the Plastic and rubber line cutting pliers - VAS 6228- or a sharp knife.
- The corrugated line must never be cut with a side cutter.
- The corrugated line must be cut on the crest of the curve -arrow-, not on the bottom.
- The corrugated line must fit onto the assembly into the fibre optic cable body.



– Insert the fibre optic cable, as shown in the figure, into the corrugated line assembly pliers - VAS 6223/10- .

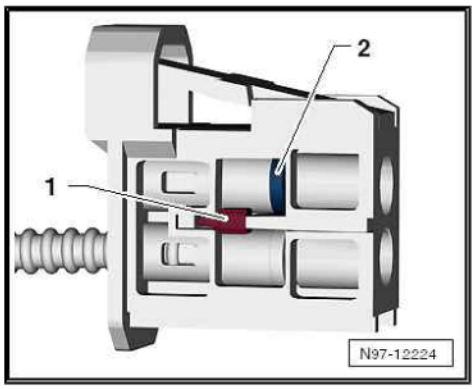
– Place the corrugated line assembly pliers on the corrugated line's opening.

– Push the corrugated line assembly pliers throughout the opening in the perimeter of the corrugated line. The fibre optic cable is then placed into the corrugated line.



2.5.2 Fibre optic cable of the the cable set connector - separate

Remove



- Remove the fibre optic cable connector from the affected control unit.
- Unlock the fibre optic cable connector by pressing the lock -1-.
- Unlock the secondary lock -2- with a small screwdriver.
- Remove the fibre optic cable.

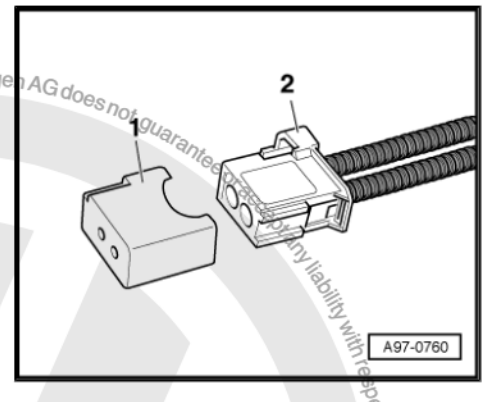
Caution

- *Use protection covers to protect fibre optic cables against dust and dirt.*
- *Use the new housing, since the secondary lock may be damaged when removing the fibre optic cable.*
- *Follow the arrows on the basic module for the "IN" and "OUT" orientations.*

Install

Installation is carried out in reverse sequence. However, the following must be observed:

- Only install fibre optic cables as identified.



Note

- *Insert the corrugated line onto the connector housing until it is audibly secured in place.*
- *Close the open connector -2- for the fibre optic cable with the Fibre optic cable connector protection cover - VAS 6223/9- -Pos. 1-.*
- *The protection cover prevents contamination or mechanical damages to the front surface of the fibre optic cable, otherwise this may compromise light transmission in the cable.*

2.6 Aerial cable repairs

2.6.1 Repair kit, aerial cable VAS 6720

Aerial cable inspection: ⇒ page 131

Replace the tool head: ⇒ page 131

Cut aerial cables: ⇒ page 132

Strip protection: ⇒ page 132

Strip the outer lining: ⇒ page 135

Strip the inner lining: ⇒ page 136

Crimp the internal conductor: ⇒ page 137

Crimp the external conductor: ⇒ page 139

Special tools and workshop equipment required

♦ Aerial cable repair set - VAS 6720-

The Aerial cable repair set - VAS 6720- allows ideal repair in the RG 174 (blue) and RTK 031 (black) aerial cable repair areas. The set contains the respective stripping and crimping tools for both aerial cables. All other components required to assembly the original socket similarly to factory conditions are available in the set. This only requires the zero-coded coupler (green). All other connection cables for different Infotainment systems are available in (ETKA (EL - electrical connection element) in the 035-XX illustrated panel. These special aerial cable adapters based on the vehicle type must always be ordered separately. The aforementioned illustrated panel also contains all individual parts for subsequent orders. The set's material compartments are identified with respective part numbers. The repair kit is based on replacement heads available and the pliers system of VAS 1978B.

Note

Additional Information: ⇒ Instruction manual of the Aerial cable repair set - VAS 6720-

Aerial cable inspection:

Test the respective aerial cable using a calibrator before initiating repairs.

♦ -1- RG 174 system = blue

♦ -2- RTK 031 system = grey

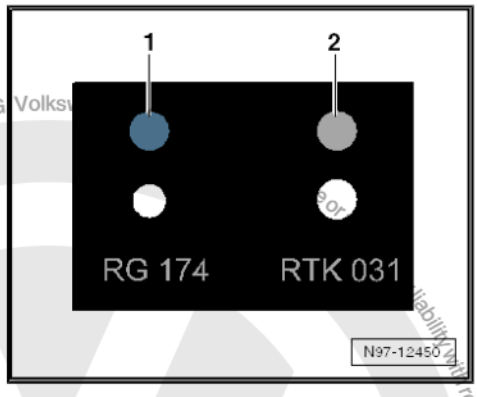
In both systems, the positioning of tool heads is respectively identified with colours.

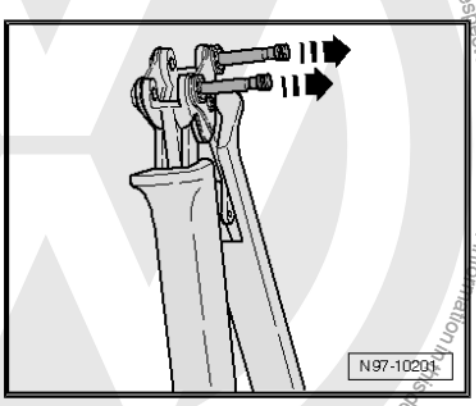
Replace the tool head:

– Select the corresponding tool head according to the aerial cable test ⇒ page 131 .

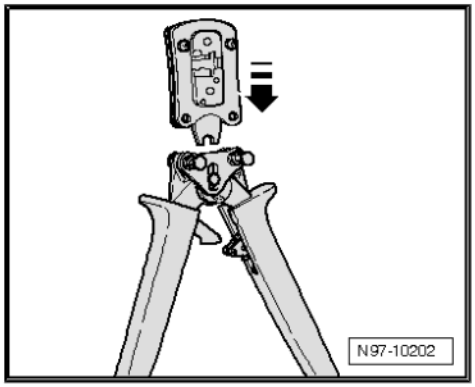
– Open the pliers completely.

– Unlock and remove both locking pins -arrows- from the pliers.



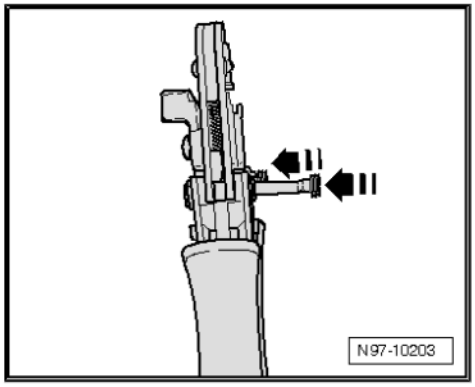


– Place the required replacement head over -arrow- the pliers.



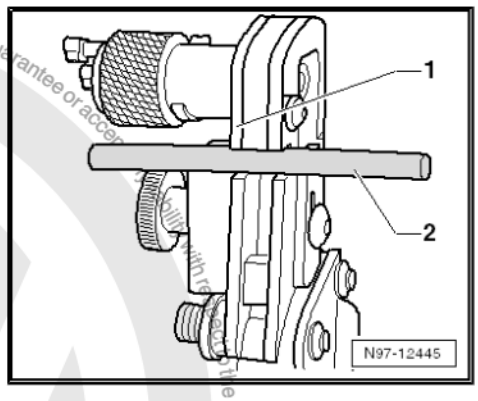
– Lock the replacement head by pressing the pins -arrow- in the pliers.

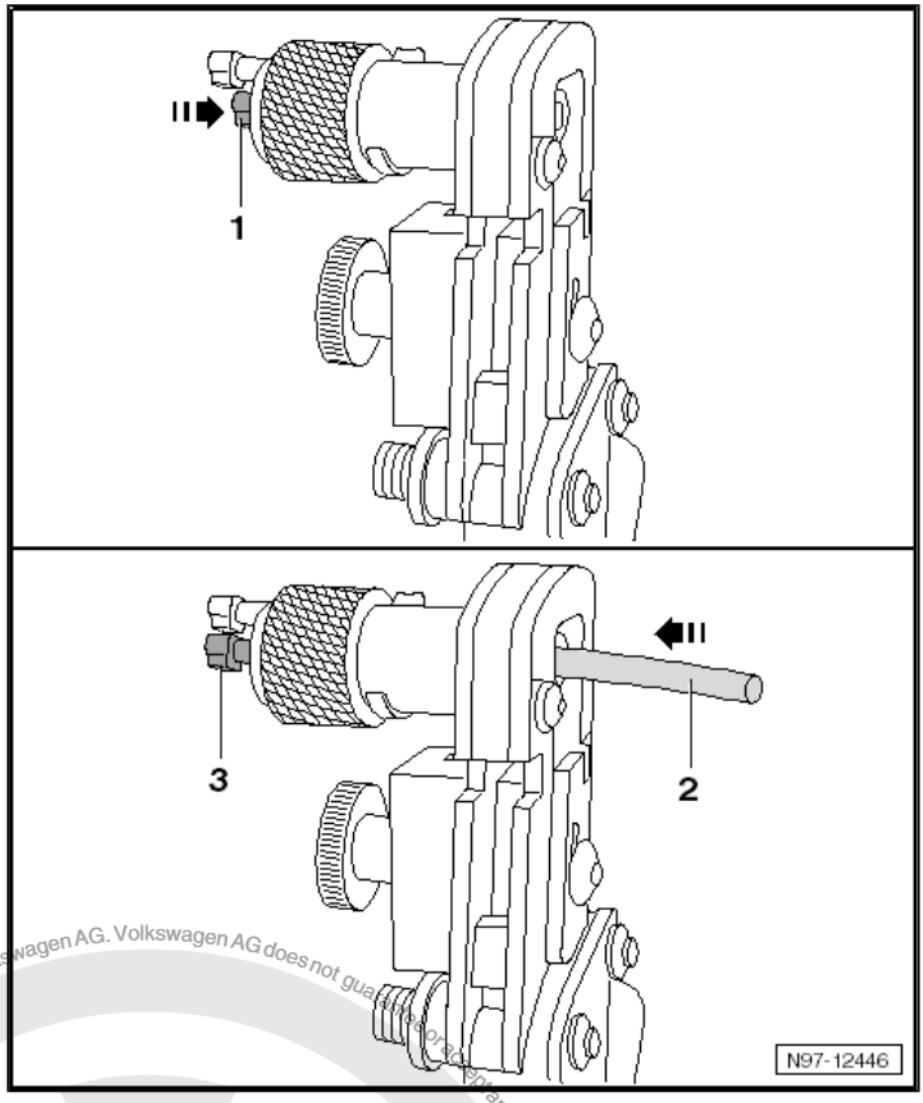
Cut aerial cables:



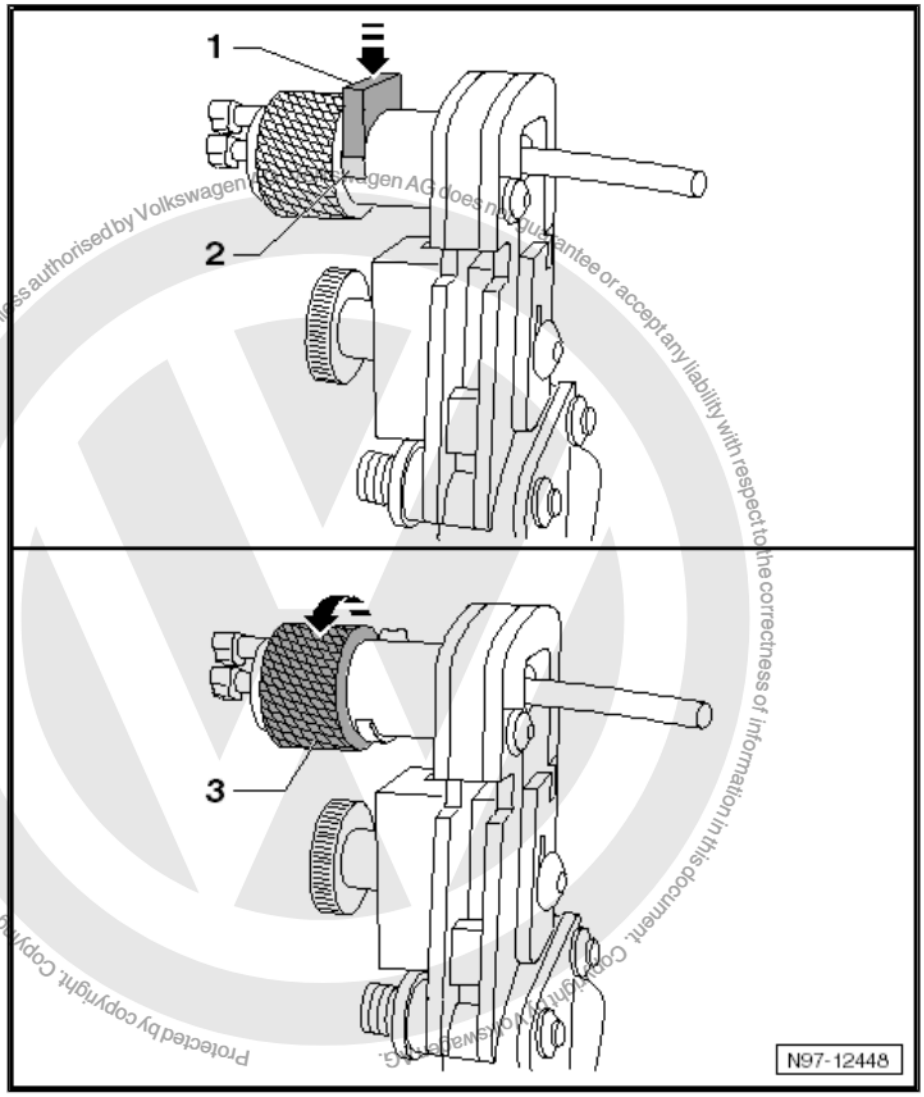
– Insert the aerial cable -2- in the cutting device -1-.
– Close the tool and open it again.
– Remove the aerial cable from the cutting device.

Strip protection:

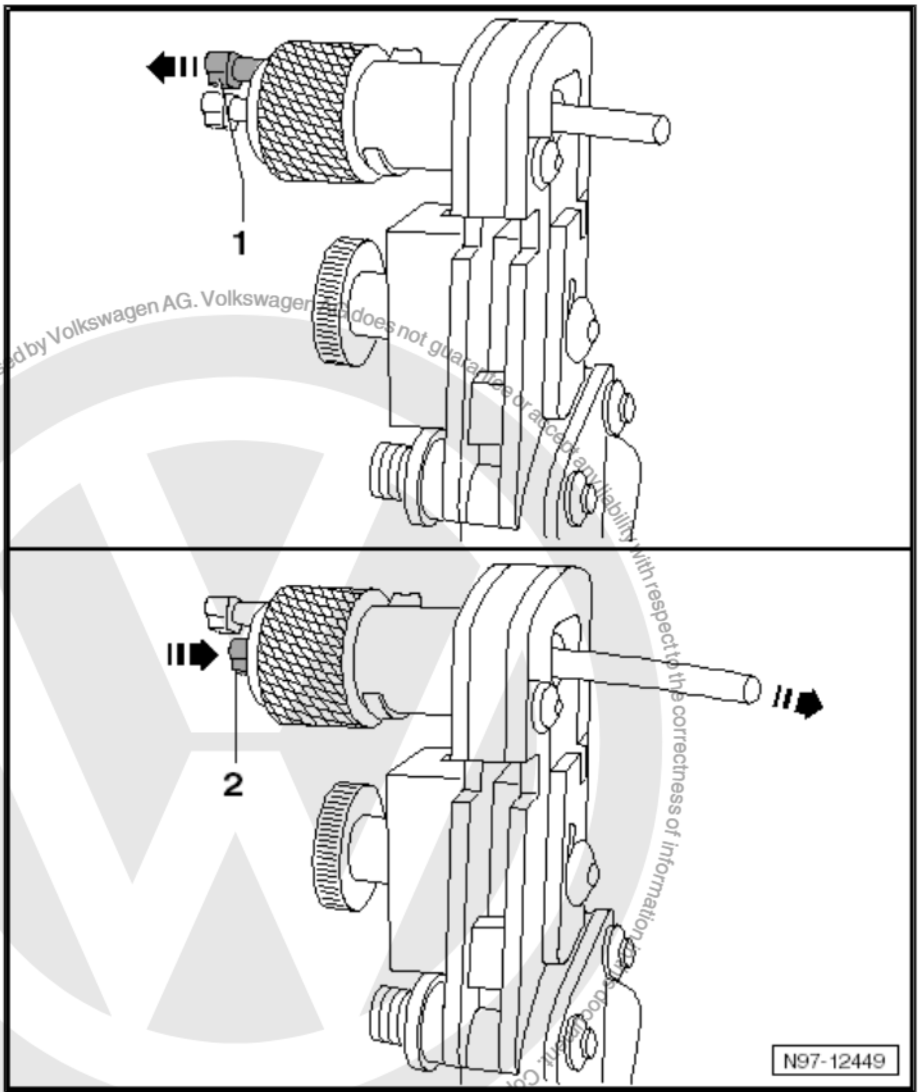




– Insert the fastening pin -1- in the rotating cutting segment until reaching the stop.
– Insert the aerial cable -2- in the rotating cutting segment until reaching the stop. The fastening pin -3- can be seen once again.

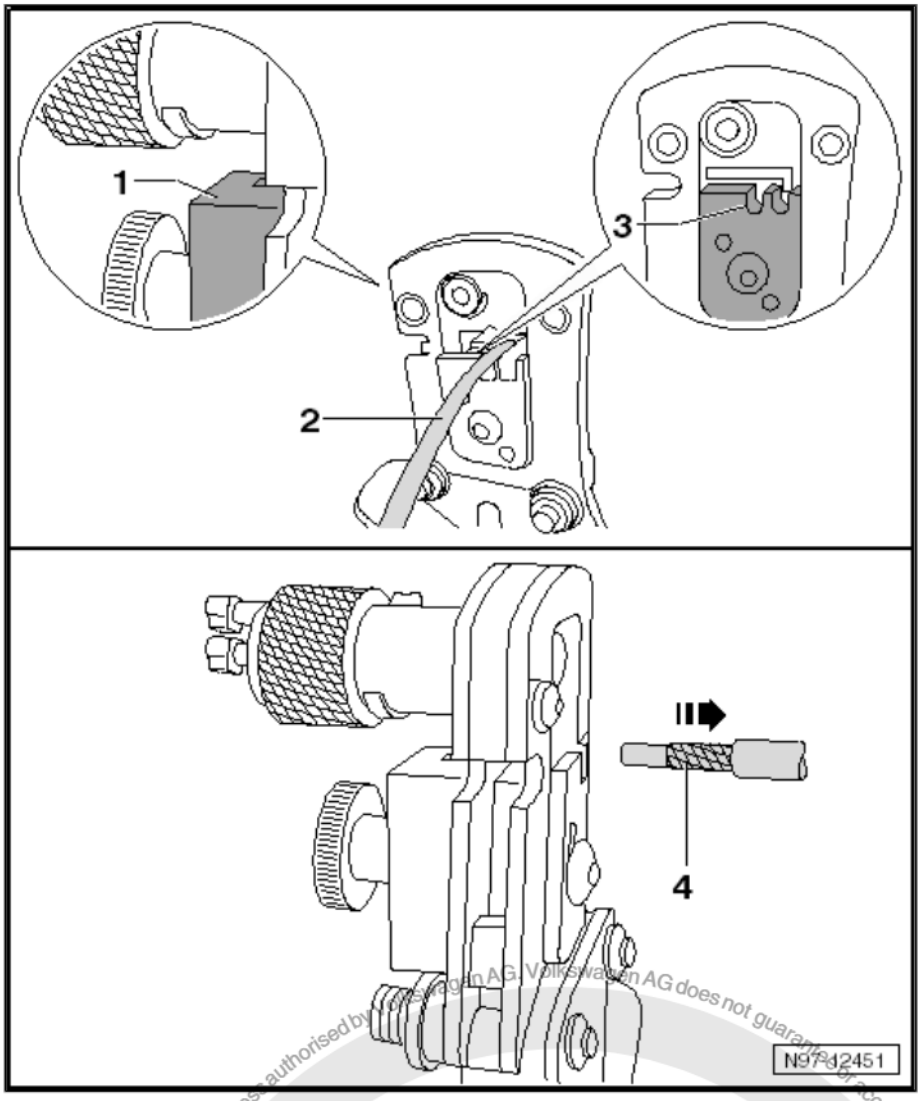


– Press the blade support -1- against the rotating cutting segment axis until it is locked in place. The opening -2- under the blade support must be completely closed.
– Hold the aerial cable to keep it from turning.
– Turn the rotating cutting segment -3- approximately 2 times in the direction of the arrow until it turn smoothly.



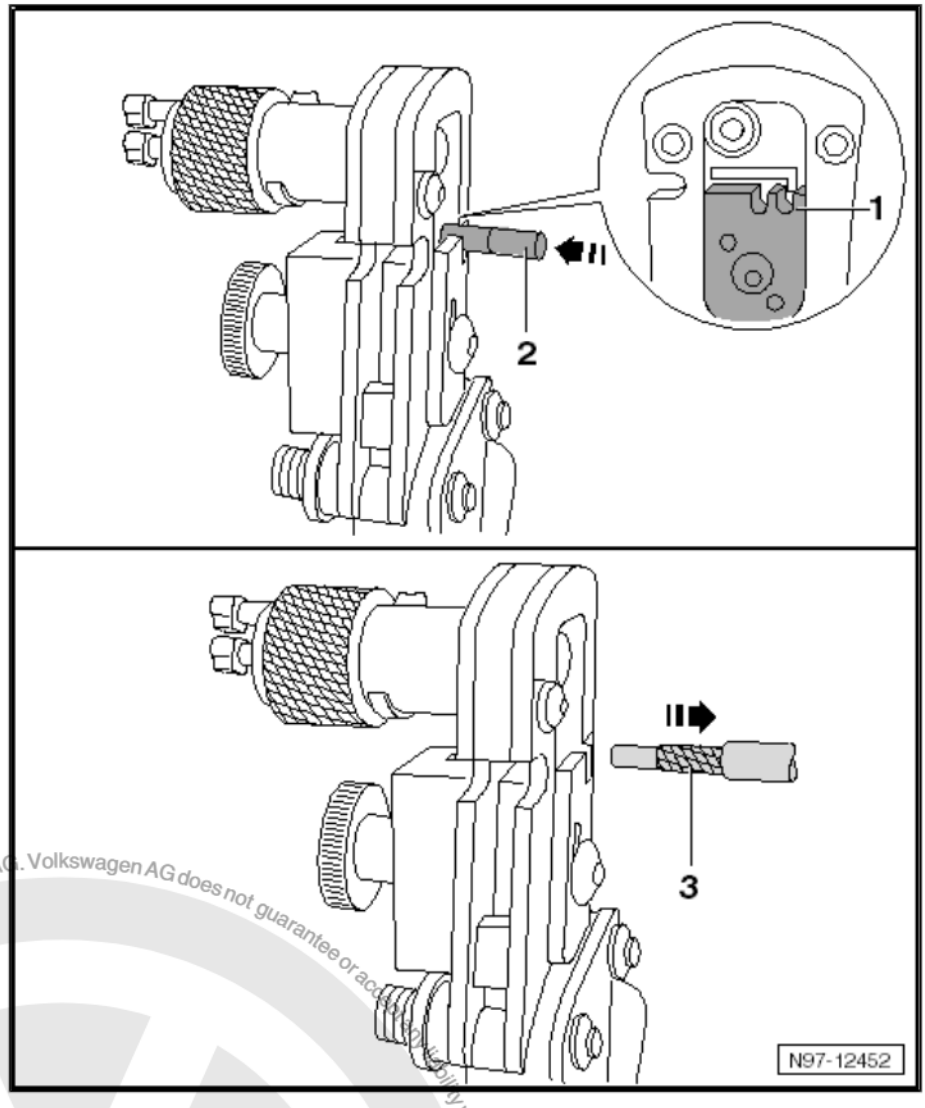
– Pull the unlocking pin -1-. The blade support is unlocked and released from the aerial cable.
– Insert the fastening pin -2- in the rotating cutting segment until reaching the stop. The aerial cable is pressed onto the rotating cutting segment.
– Remove the aerial cable shielding.
– Remove insulation scraps from the rotating cutting segment.

Strip the outer lining:



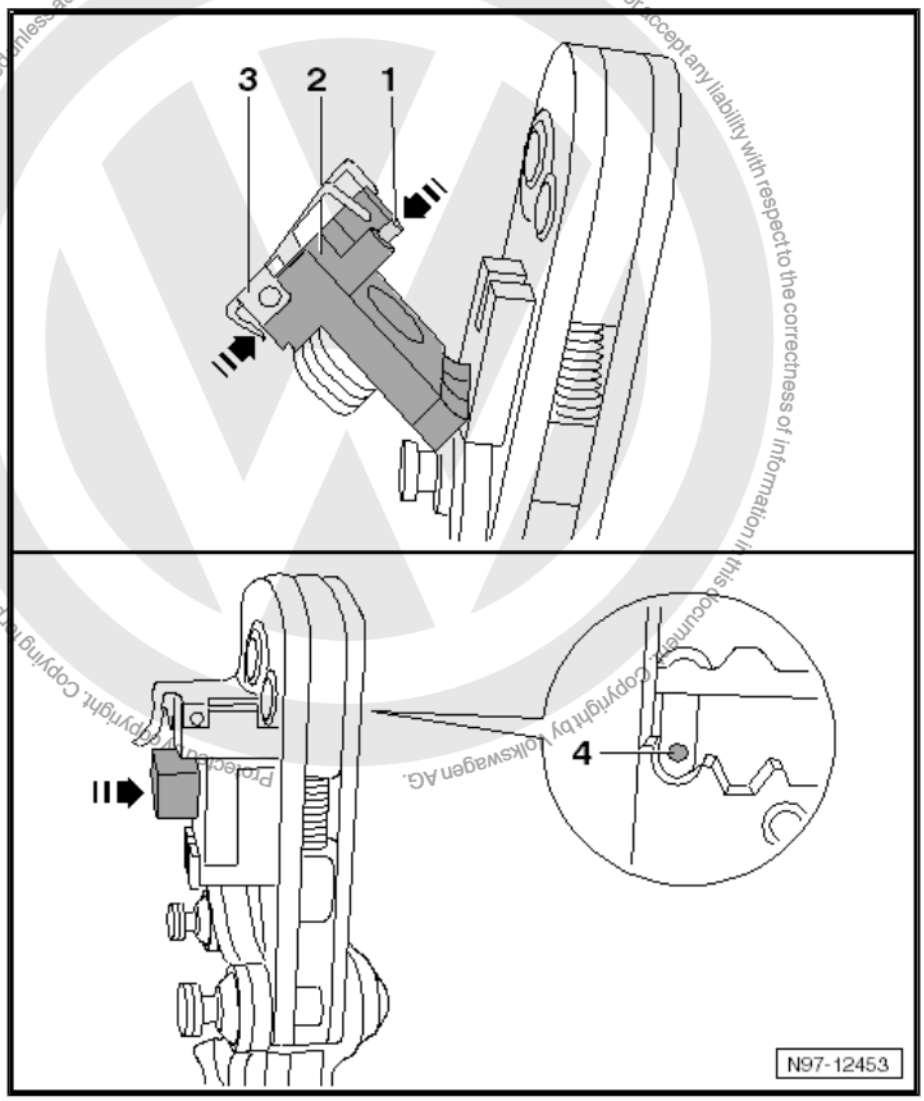
– Insert the aerial cable -2- into the housing -3- until the stop -1- in the tool head.
– Close the tool and open it again.
– Remove the aerial cable -4-.

Strip the inner lining:

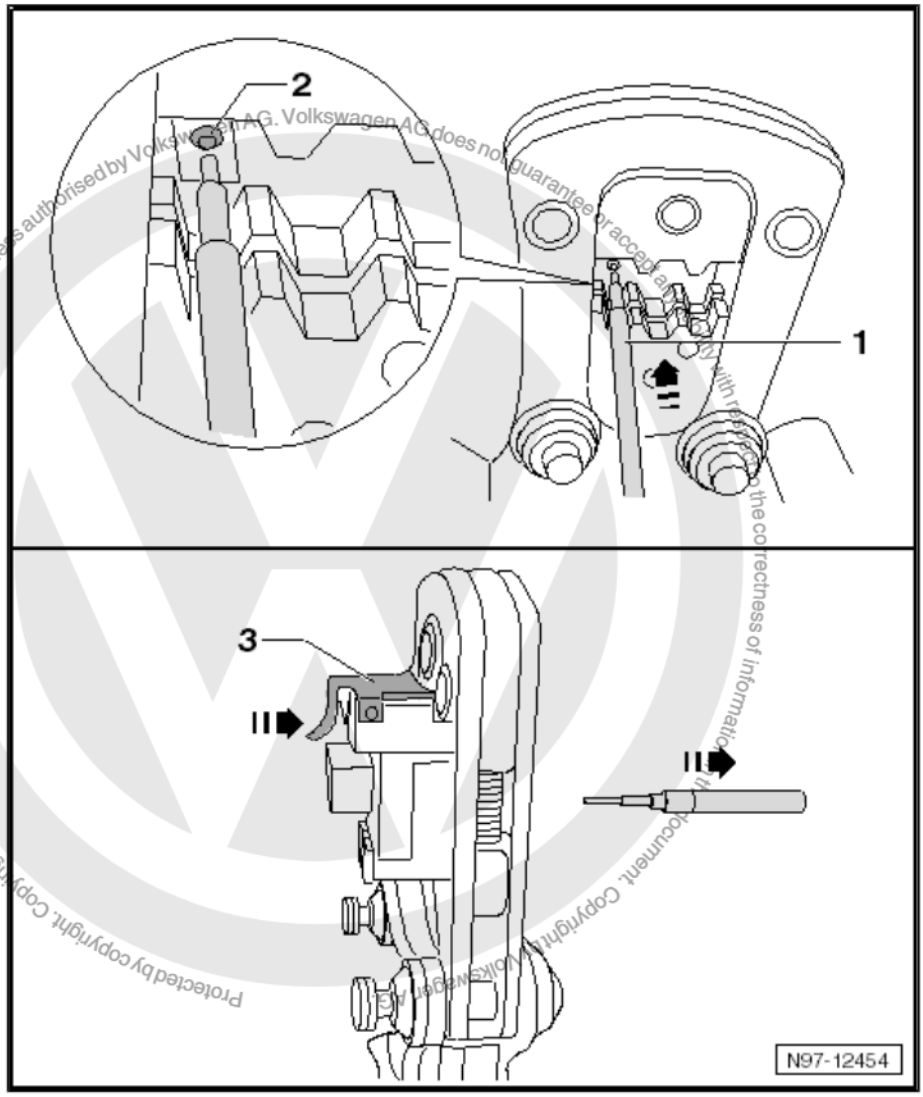


– Insert the aerial cable -2- into the housing -1- until the stop in the tool head.
– Close the tool and open it again.
– Remove the aerial cable -3-.

Crimp the internal conductor:

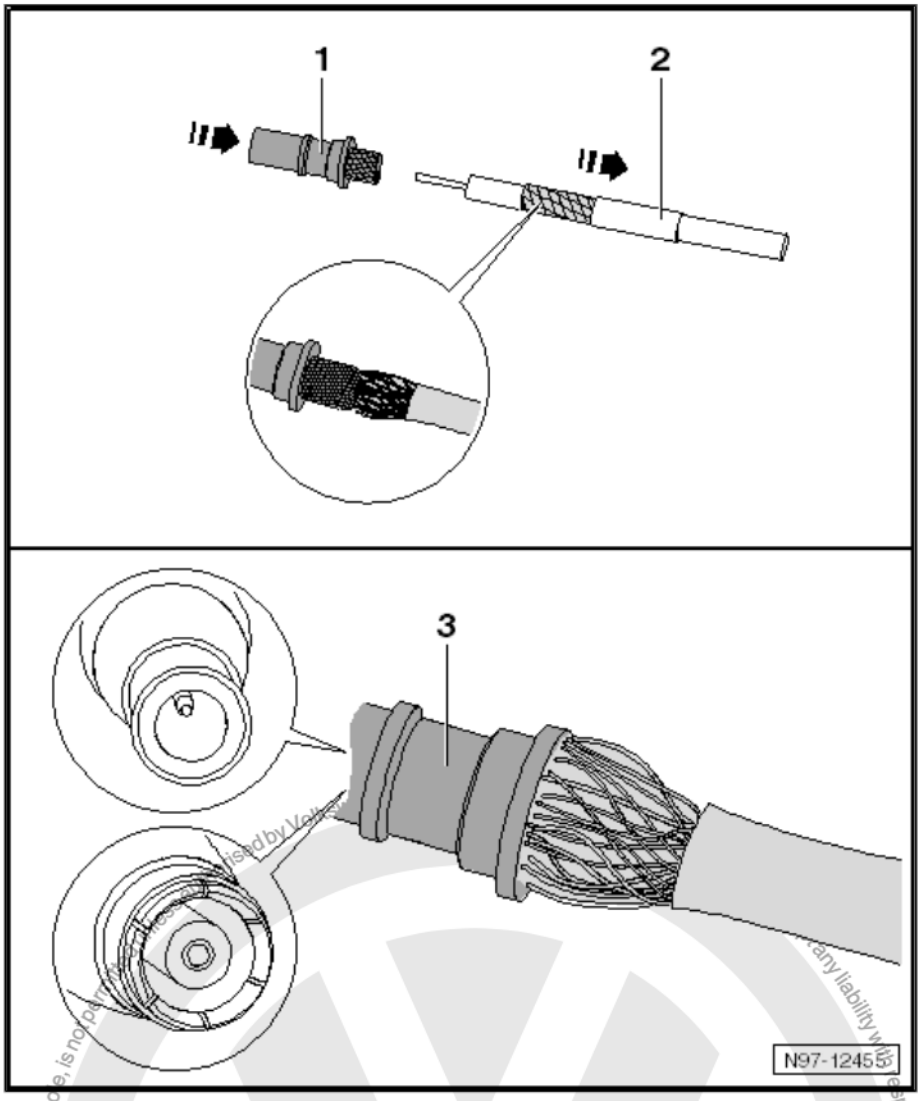


- Select the corresponding tool head ⇒ page 131 according to the aerial cable test ⇒ page 131 .
- Unfold the swinging guide -2-.
- Open the positioning plate -3-. The positioning plate swings up.
- Insert the internal contact -1- until the stop of the swinging guide and release the positioning plate. The internal contact is secured in place.
- Fold the swinging guide. The internal contact -4- is positioned on the tool head.

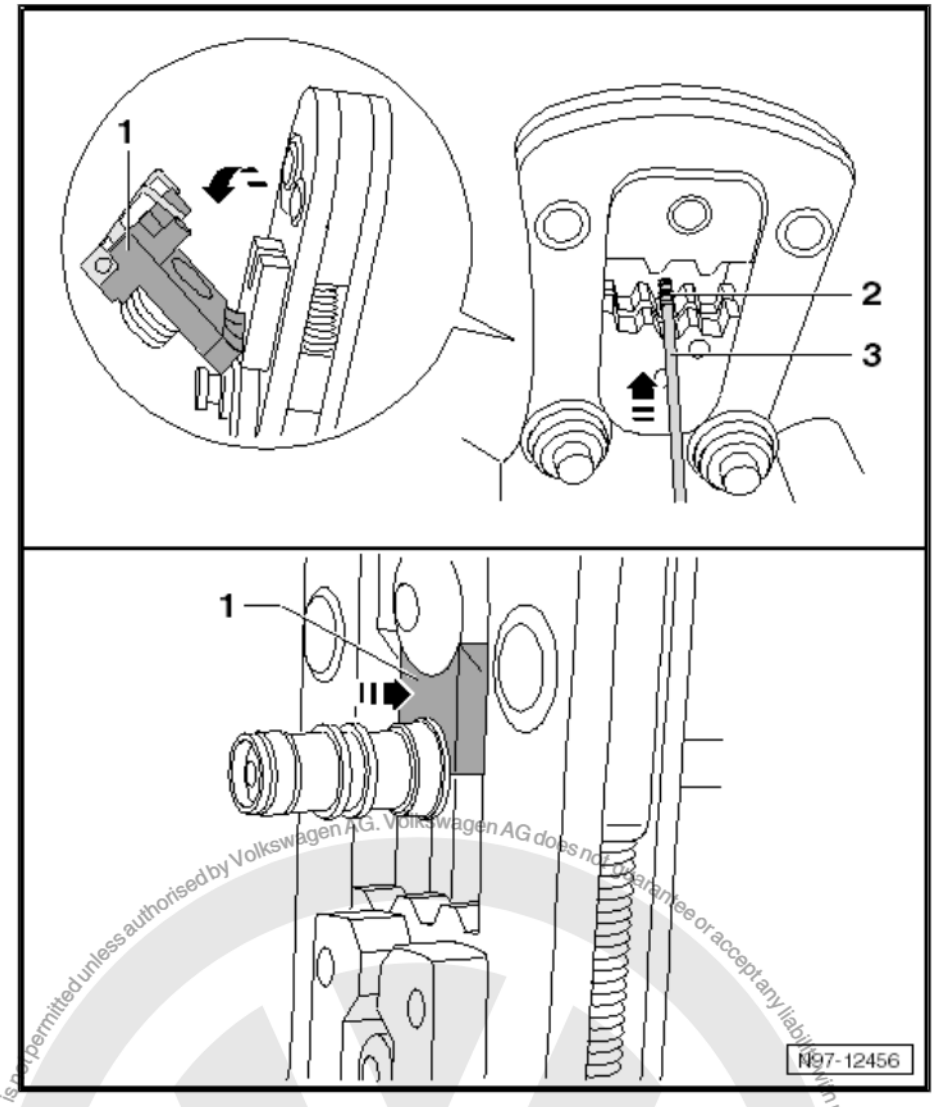


– Insert the aerial cable -1- into the internal contact -2- on the tool head. For such, keep the swinging guide in position.
– Close the tool until it opens automatically.
– Open the positioning plate -3- and remove the aerial cable.

Crimp the external conductor:



– Place the sleeve -2- and the external contact -1- over the internal conductor. The knurled part of the contact must be inserted under the shielding -3- and above the aluminium sheet.
– Push the external contact completely -4-. Ensure the bushing/ pin is properly seated in place.



– Push the sleeve -3- until the external contact.
– Open the tool and unfold the swinging guide -1-.
– Place the external contact -2- assembled on the tool head in the centre profile of the support rim -4-.
– Close the tool and open it again.
– Remove the aerial cable.

2.7 Repairing connector terminals and connectors

⇒ “2.7.1 Notes regarding repair work on connector terminal and connectors”, page 142

⇒ “2.7.2 Repairing connector terminals”, page 142

⇒ “2.7.3 Assembly of simple cable linings”, page 143

⇒ “2.7.4 Repairing connectors with the cutting/compression technique”, page 145

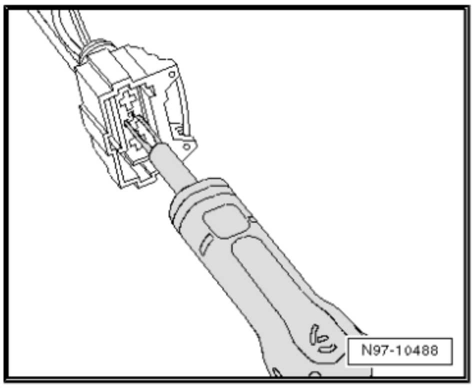
2.7.1 Notes regarding repair work on connector terminal and connectors

Note

- *Pay attention to the notes regarding repair work on the electrical system* *⇒ “2.1 General notes on repair work on the electrical system of the vehicle”, page 97* *.*
- *Matching the terminals for cleaving with the respective connectors is carried out according to the part number engraved on the corresponding connector ⇒ Electronic Parts Catalogue“ETKA”*
- *Any damaged connectors should be replaced.*

2.7.2 Repairing connector terminals

– If necessary, first open or unlock the secondary locking device of the connector terminals ⇒ page 146 .



– Unlock the terminal (primary locking device) with an appropriate unlocking tool ⇒ page 146 .

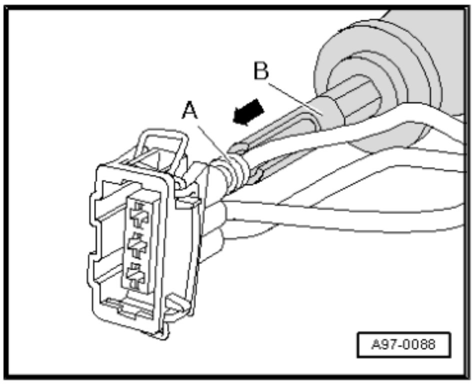
– Pull the simple cable terminal and remove it from the connector.

– Select the yellow repair cable with the correct terminal of the Harness repair set - VAS 1978- or Harness repair kit - VAS 1978A- .

– Release the section of the original cable to be repaired (approx. 20 cm on both sides of the section to be repaired).

– If necessary, remove the cable lining with a penknife.

– Slot the new terminal of the repair cable onto the connector until it locks in.

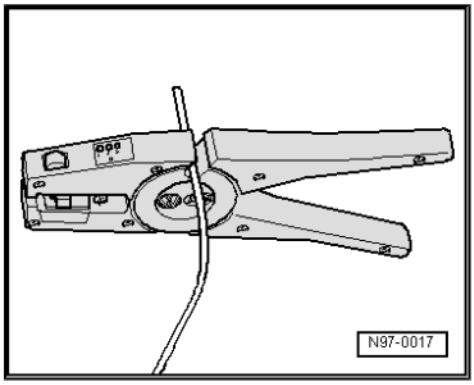


– If necessary, insert the lining of the simple cable -A- with its respective assembly tool -B- until the stop in the connector.

Note

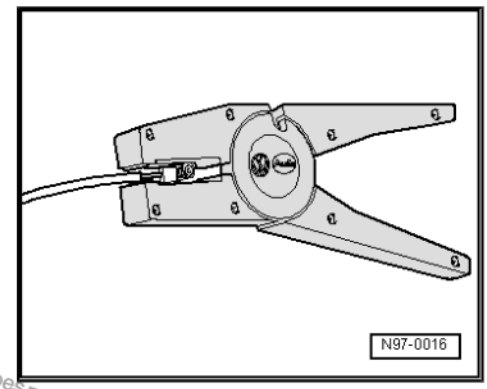
The smaller diameter of the lining should point towards the connector.

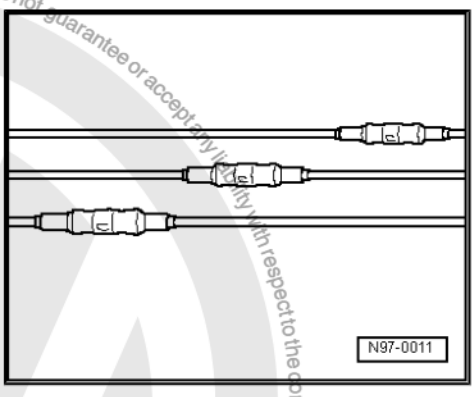
– Shorten the repair cable and original simple cable as necessary, with the Cable stripping pliers - VAS 1978/3- .



– Strip 6 or 7 mm from the ends of the repair cable and the original simple cable with the Cable stripping pliers - VAS 1978/3- .

– Compress the stripped ends of the repair cable and the simple cable of the original harness with the cleaving pliers and a pressure connection, as described in the chapter entitled “Interruption in cables with a repaired section” ⇒ page 121 .





Note

- *In the event that more than one cable needs repairing, ensure that the pressure connections are not placed together. In order to prevent the section of cables from occupying too much space, position the pressure connection slightly away.*
- *In the event that the repaired section is warped, rewrap the location with yellow adhesive after repairs have been carried out.*
- *If necessary, secure the repaired cables with a clamp, this avoiding the generation of any noise when the vehicle is later driven.*

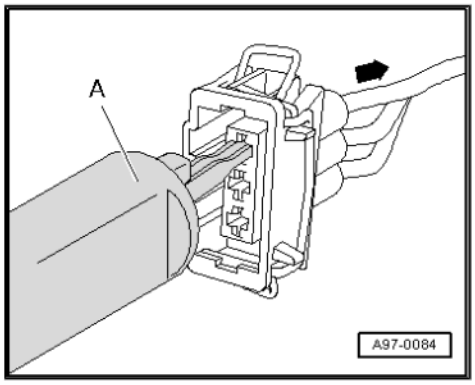
2.7.3 Assembly of simple cable linings

Note

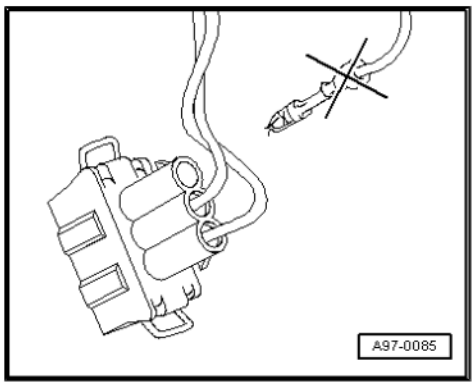
- *Simple cable linings prevent water and dirt from getting into the connector. These linings are assembled, e.g. in the engine compartment, and should be reassembled whenever a repair has been carried out.*
- *The lining of original simple cables is cleaved onto the cable together with the terminal; this is not the case when the cable is repaired. Thus, before compressing the repair cable, insert the lining onto the cable.*
- *Simple cable linings must be adapted to the cross section of the repair cable used. The external diameter of the lining of simple cables matches the diameter of the connector chamber. Assembly must only be executed with an appropriate assembly tool.*

Assembly of simple cable linings:

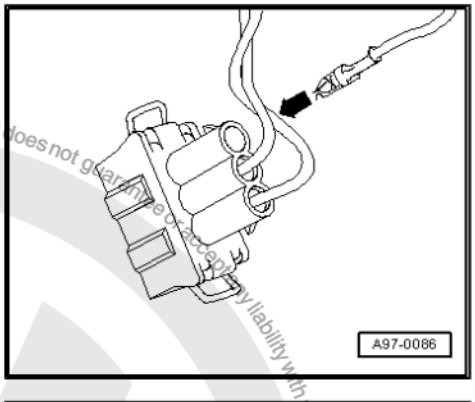
– With an appropriate unlocking tool -A-, release the terminal and remove the cable with its respective lining -arrow- from the connector, by pulling it backwards.



– Cut off the old terminal together with the respective lining of the original cable.



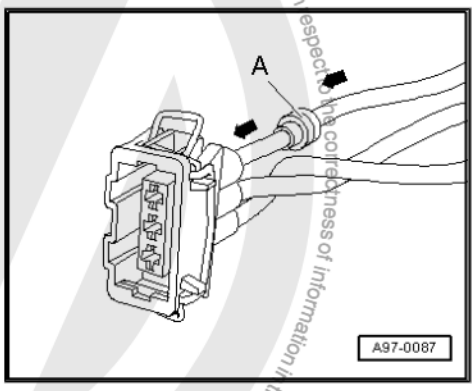
– Insert the repair cable with the new terminal into the respective connector mounting until it locks into place.



– Insert the lining of the simple cable -A- into the free end of the repair cable.

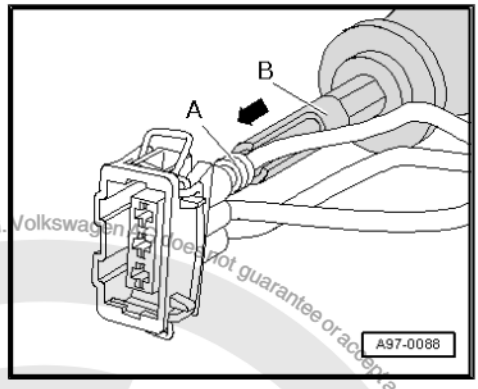
Note

The smaller diameter of the lining should point towards the connector.

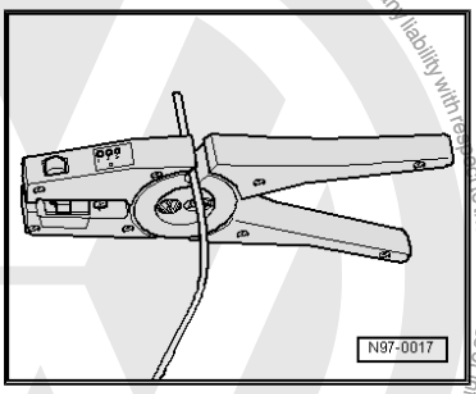


– Move the lining of the simple cable -A- onto the repair cable, up to the connector.

– Insert the lining of the simple cable -A- with its respective assembly tool -B- until the stop in the connector.



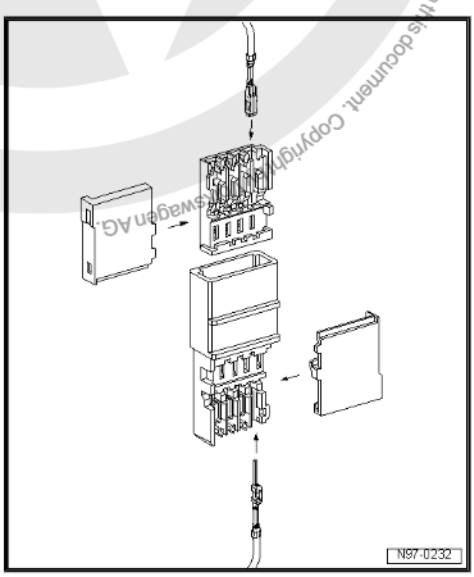
– Shorten the repair cable and the original single cable of the wiring harness as necessary, with the Cable stripping pliers - VAS 1978/3- .
– Compress the stripped ends of the repair cable and the simple cable of the original harness with the cleaving pliers and a pressure connection, as described in the chapter entitled “Interruption in cables with a repaired section” ⇒ page 121 .



2.7.4 Repairing connectors with the cutting/ compression technique

Note

- *For technical reasons, the connectors pertaining to the cutting/ compression procedure may be supplied exclusively with compression/cutting terminals already inserted.*
- *In the event they are not necessary, these terminals may be removed in the same way as all the others.*
- *The repair cables supplied already have integrated terminals with a corresponding cleaving process ⇒ Electronic Parts Catalogue “ETKA” .*



2.8 Unlocking and disassembling the terminals

⇒ “2.8.1 Note regarding the unlocking and disassembly of the connectors”, page 146

⇒ “2.8.2 Secondary locking”, page 146

⇒ “2.8.3 Primary locking”, page 147

⇒ “2.8.4 Fastening systems for round terminals”, page 148

⇒ “2.8.5 Fastening systems for flat terminals”, page 148

⇒ “2.8.6 Fastening device for special terminals”, page 150

2.8.1 Note regarding the unlocking and disassembly of the connectors

Note

- *Pay attention to the notes regarding repair work on the electrical system ⇒ “2.1 General notes on repair work on the electrical system of the vehicle”, page 97 .*
- *Always use an appropriate unlocking tool for the purpose of unlocking the terminal. The terminals must not, under any circumstances, be forced from the connectors.*
- *Any damaged connectors should be replaced.*
- *Use a small screwdriver in order to release the secondary locking devices.*
- *Occupation of the pins is found engraved on the secondary locking device or the rear section of the connector.*
- *Additional information regarding the location of assembly of terminals ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*

The appropriate tools for disassembly indicated for the respective locking devices can be consulted in a table in the ⇒ Instruction manual for the Cleaving pliers - VAS 1978/1- .

2.8.2 Secondary locking

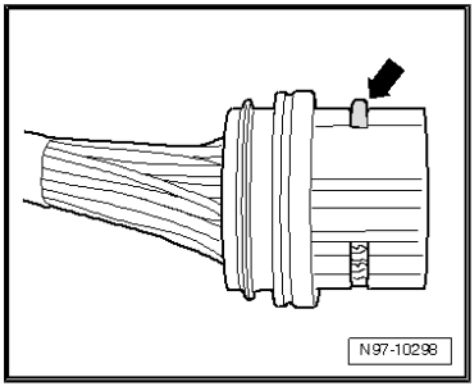
The secondary locking device is a fastening device (additional locking device) which fastens all the cables to a connector. If a connector has a secondary locking device, this should always be unlocked or removed with an appropriate tool, before unlocking and removing a terminal.

The secondary locking device is recognizable from the other components of the connector by its colour. This simplifies recognition of the secondary locking device and clarifies it respective purpose.

The types of connectors below are only some examples in order to illustrate the different operational modes of the secondary locking devices.

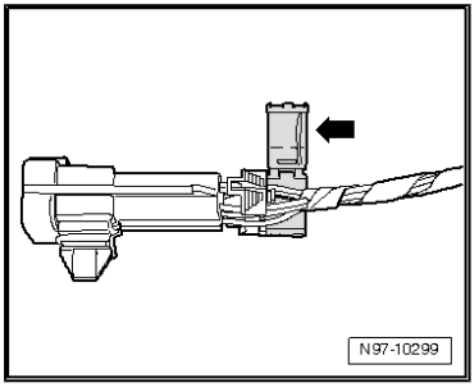
Example 1:

The locking device is released upon removal “comb type element” -arrow-.



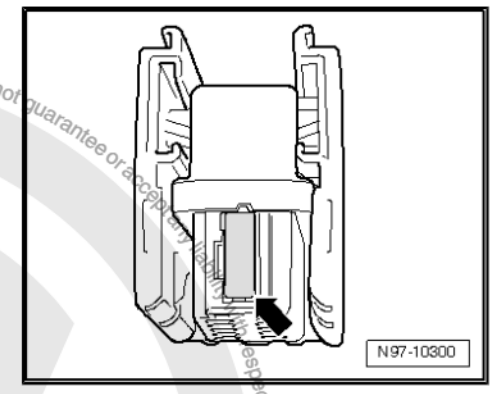
Example 2:

The locking device is released when a “cap” -arrow-is opened.



Example 3:

The locking device is released when a “sliding lock” -arrow-is removed.



2.8.3 Primary locking

The primary locking device is the slot that fastens a terminal to a connector.

If there are secondary locking devices, unlock or remove these with an appropriate tool, before releasing the terminals ⇒ page 146 .

The types of connectors below are only some examples in order to illustrate the different operational modes of the primary locking devices.

- Fastening systems of round terminals ⇒ page 148
- Fastening systems of flat terminals ⇒ page 148
- Fastening systems of special terminals ⇒ page 150

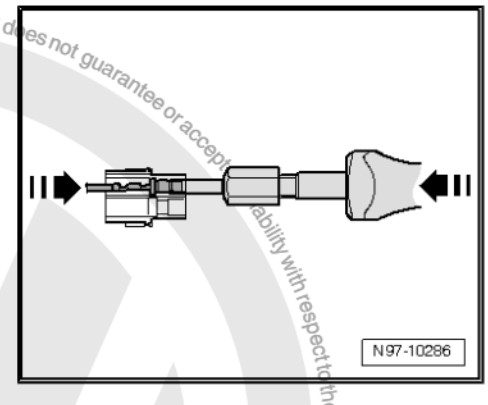
The appropriate tools for disassembly indicated for the respective locking devices can be consulted in a table in the ⇒ Instruction manual for the Cleaving pliers - VAS 1978/1- .

2.8.4 Fastening systems for round terminals

Note

If there are secondary locking devices, unlock or remove these with an appropriate tool, before releasing the terminals *⇒ page 146* .

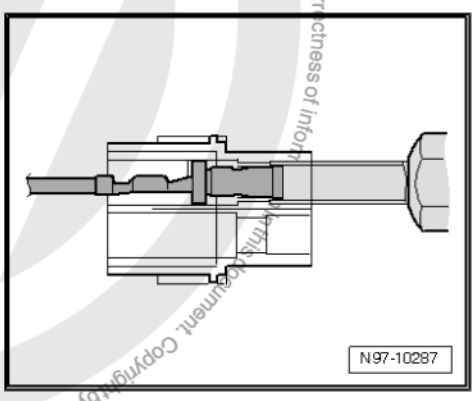
- Insert the unlocking tool indicated for the connector in question into the unlocking groove.
- Slot the terminal onto the cable and press it lightly into the connector -arrow-.
- Press the unlocking tool towards the connector -arrows- and remove the loose terminals from the connector.



Note

When pressing the terminal towards the connector, the fastening locks are released from the connector, thus enabling their removal with an unlocking tool.

- After removing the terminal, the unlocking tool can be removed from the connector.



2.8.5 Fastening systems for flat terminals

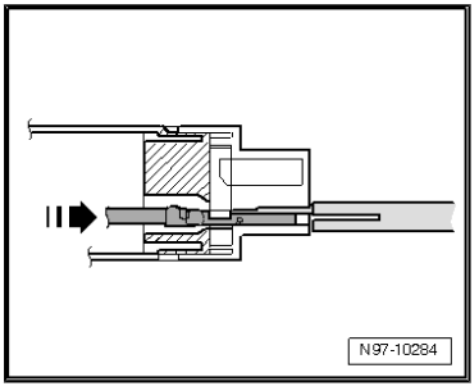
Note

If there are secondary locking devices, unlock or remove these with an appropriate tool, before releasing the terminals *⇒ page 146* .

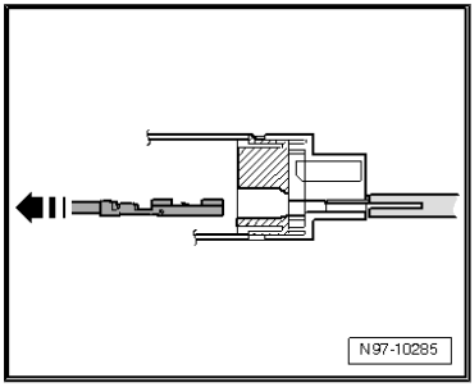
Fastening system for flat terminals with a fastening protrusion:

- Insert the unlocking tool indicated for the connector in question into the unlocking groove.

– Slot the terminal onto the cable and press it lightly into the connector -arrow-.



– Press the unlocking tool towards the connector -arrows- and remove the loose terminals from the connector.



Note

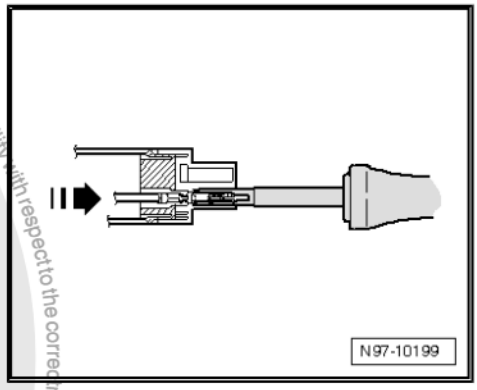
When pressing the terminal towards the connector, the fastening locks are released from the connector, thus enabling their removal with an unlocking tool.

– After removing the terminal, the unlocking tool can be removed from the connector.

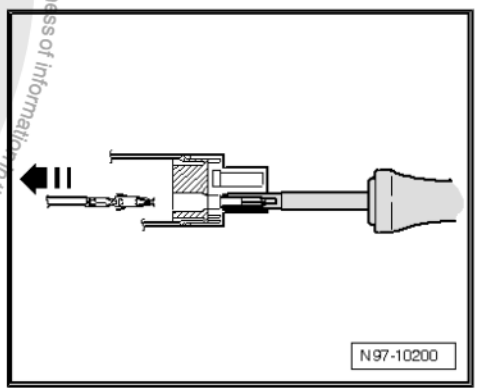
Fastening system for flat terminals with two fastening protrusions:

– Insert the unlocking tool indicated for the connector in question into the unlocking groove.

– Slot the terminal onto the cable and press it lightly into the connector -arrow-.



– Press the unlocking tool towards the connector -arrows- and remove the loose terminals from the connector.



Note

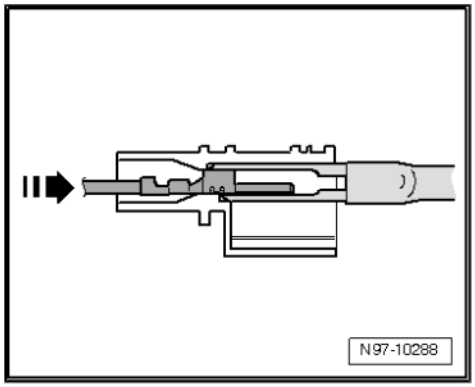
When pressing the terminal towards the connector, the fastening locks are released from the connector, thus enabling their removal with an unlocking tool.

– After removing the terminal, the unlocking tool can be removed from the connector.

Asymmetry:

– Insert the unlocking tool indicated for the connector in question into the unlocking groove.

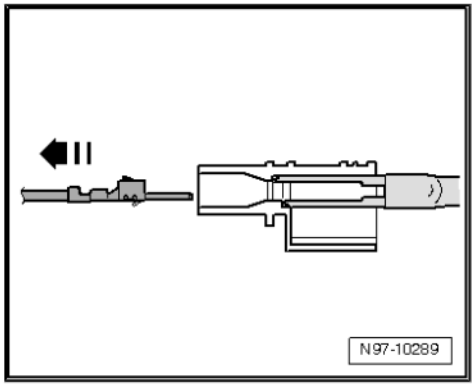
– Slot the terminal onto the cable and press it lightly into the connector -arrow-.



Note

When pressing the terminal towards the connector, the fastening locks are released from the connector, thus enabling their removal with an unlocking tool.

– Press the unlocking tool towards the connector-arrows-and remove the loose terminals from the connector.
– After removing the terminal, the unlocking tool can be removed from the connector.



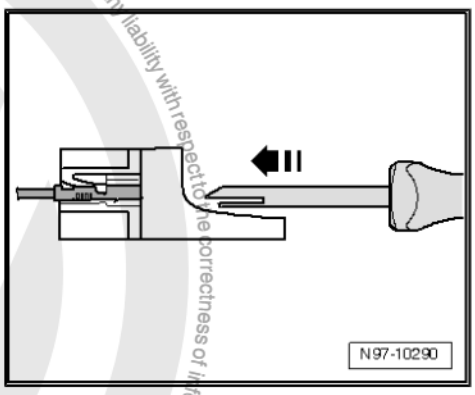
2.8.6 Fastening device for special terminals

Note

If there are secondary locking devices, unlock or remove these with an appropriate tool, before releasing the terminals *⇒ page 146* .

Faston auxiliary terminals:

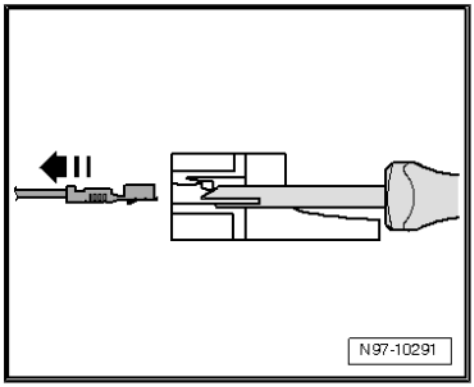
– Insert the unlocking tool indicated for the connector in question into the unlocking groove.
– Slot the terminal onto the cable and press it lightly into the connector -arrow-.



Note

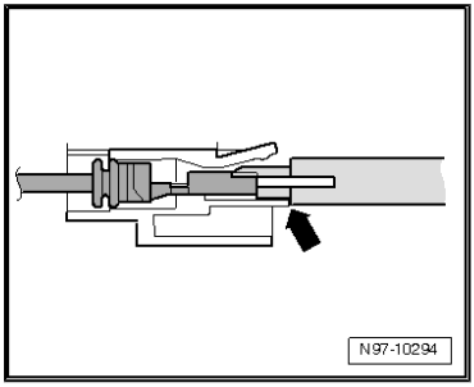
When pressing the terminal towards the connector, the fastening locks are released from the connector, thus enabling their removal with an unlocking tool.

– Press the unlocking tool towards the connector-arrows-and remove the loose terminals from the connector.
– After removing the terminal, the unlocking tool can again be removed from the terminal box.



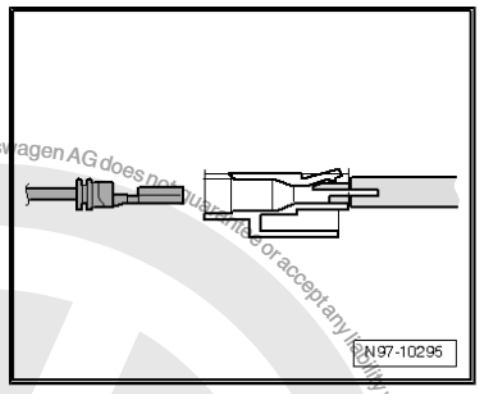
GT 150/280 terminals:

– Insert the unlocking tool indicated for the connector in question into the unlocking groove.
– Slot the terminal onto the cable and press it lightly into the connector -arrow-.



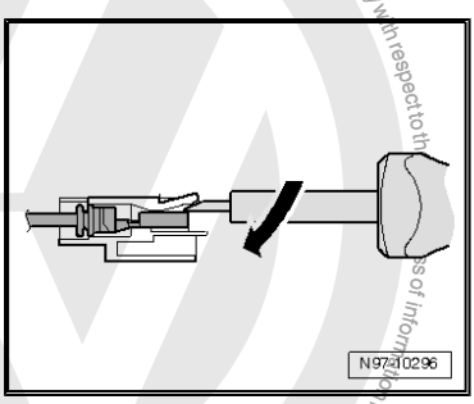
The terminal is cast off the connector.

– After removing the terminal, the unlocking tool can again be removed from the terminal box.



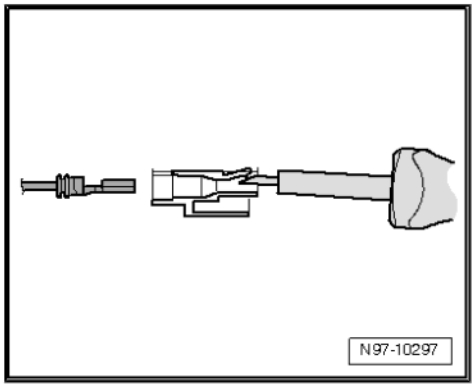
Terminals without fastening protrusions:

– Insert the unlocking tool under the fastening protrusion of the connector.
– Press the unlocking tool to the stop and lightly lift it -arrow-.



The terminal is cast off the connector.

– After removing the terminal, the unlocking tool can again be removed from the terminal box.



3 Electrical contact cleaning set - VAS 6410-

3.1 Use of the Electrical contact cleaning set - VAS 6410-

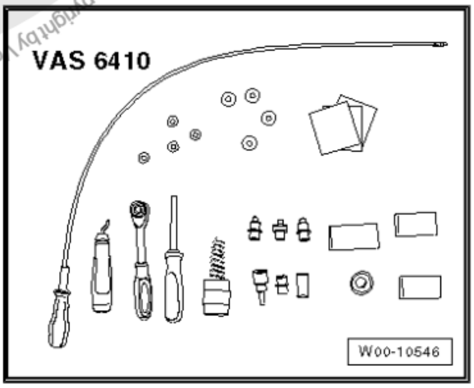
⇒ “3.1.1 Maintenance of cable eyes”, page 153
⇒ “3.1.2 Maintenance of bolted joints”, page 155
⇒ “3.1.3 Clean battery terminals”, page 156
⇒ “3.1.4 Preservation”, page 158

The Electrical contact cleaning set - VAS 6410- allows ideal repairs in the vehicle's electrical system. The tools can be used to carry out maintenance in the wiring harness contact sensor sector for bolted joints in the intense current circuit (charging and starter current). The Electrical contact cleaning set - VAS 6410- is adapted to the construction conditions of vehicles and ensures a safe process and comfortable working conditions.

Note

Maintenance work figures are provided merely for illustrative purposes.

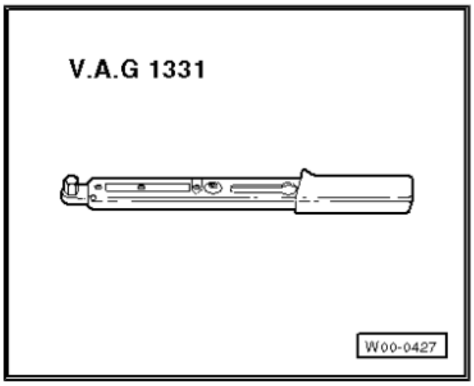
Electrical contact cleaning set



3.1.1 Maintenance of cable eyes

Special tools and workshop equipment required

- VAG 1331



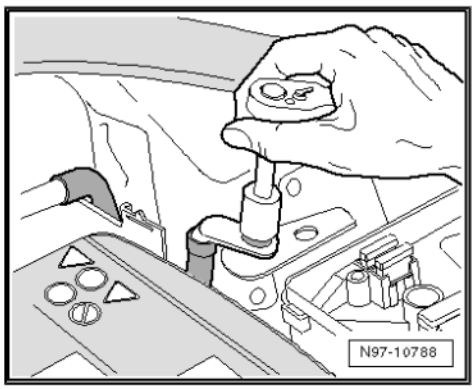
Note

- *Using rust remover, contact sprays or greases must be avoided because the lack of friction in the thread causes excess tightening torque and ultimately breaks the threaded joint.*
- *Gray sandpaper can be used for light dirt and "smooth surfaces". Red sandpaper can be used for intense dirt and "hard surfaces".*

WARNING

Risk of injuries! Follow all safety instructions!

- Disconnect the battery.
- Release the cover nut and remove the bolted cable eye.
- Inspect the cable eye for corrosion, dirt, etc.
- Select the adapter matching the respective sandpaper.



Note

Sandpaper blocks can be used alternatively.

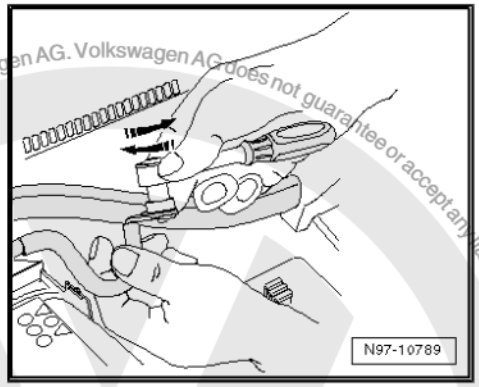
Caution

Ensure the tin layer is not excessively worn, exposing the copper. This could create a galvanic element that destroys the metal and results in defective repairs.

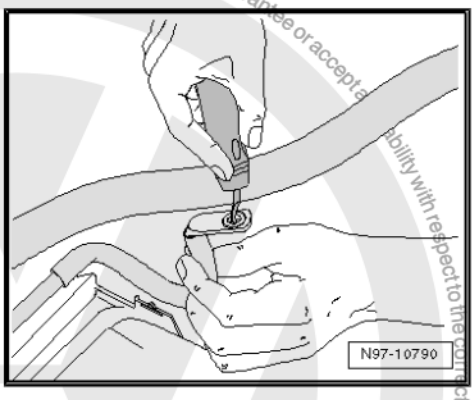
Note

Due to the thickness of layers based on the tin structure type, the cleaning process must be carried out in multiple stages and requires an intermediary visual inspection of the cable eye.

- Place the adapter in the cable eye and grind the corrosion and dirt in circular movements.
- Check the cable eye and continue grinding if necessary.



– If necessary, remove stamping residues in the cable eye using a deburrer.
– Bolt the cable eye again to the specified torque, ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Note

Ideal contact is ensured when bolted components are tightened to the specified torque after cleaning.

– Carry out joint preservation using the respective preserving medium, ⇒ page 158
– Reconnect the battery.

WARNING

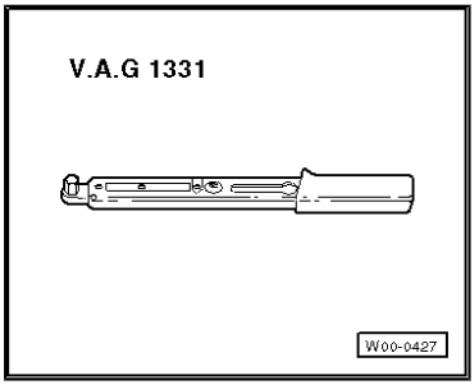
Risk of injuries! Follow all safety instructions ⇒ "1.3 Warning notes and safety norms", page 3 !

– Reprogram the electric window, insert the radio code, set the time and, if necessary, recode the control unit with fault messages.

3.1.2 Maintenance of bolted joints

Special tools and workshop equipment required

♦ VAG 1331



Note

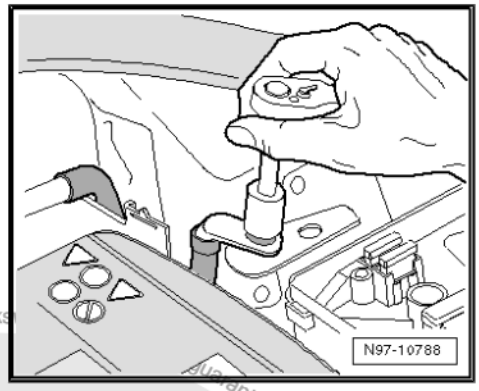
♦ *Using rust remover, contact sprays or greases must be avoided because the lack of friction in the thread causes excess tightening torque and ultimately breaks the threaded joint.*
♦ *Gray sandpaper can be used for light dirt and "smooth surfaces". Red sandpaper can be used for intense dirt and "hard surfaces".*

WARNING

Risk of injuries! Follow all safety instructions ⇒ "1.3 Warning notes and safety norms", page 3 !

– Disconnect the battery.

– Release the cover nut and remove the bolted cable eye.
– Check the bolted joint for corrosion, dirt, etc.
– Select the adapter matching the respective sandpaper for the bolted joint.

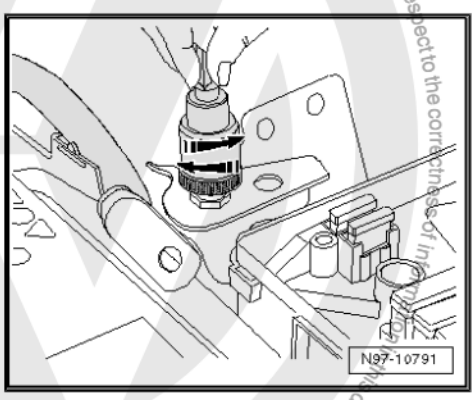


> **Caution**
>
> *Ensure the tin layer is not excessively worn, exposing the copper. This could create a galvanic element that destroys the metal and results in defective repairs.*

Note

Due to the thickness of layers based on the tin structure type, the cleaning process must be carried out in multiple stages and requires an intermediary visual inspection of the cable eye.

– Place the adapter in the bolted joint and grind the corrosion and dirt in circular movements.
– Check the bolted joint and continue grinding if necessary.
– Bolt the joint and the locating element, if necessary, tightening to the specified torque. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Note

Ideal contact is ensured when bolted components are tightened to the specified torque after cleaning.

– Carry out bolted joint preservation using the respective preserving medium, ⇒ page 158 .
– Reconnect the battery.

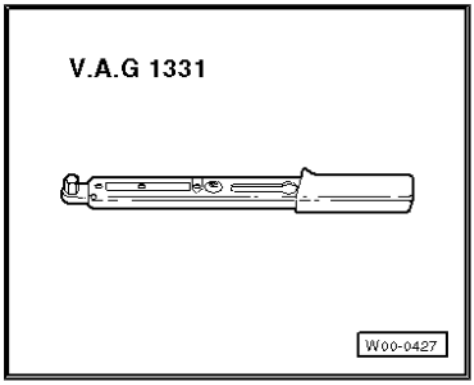
> **WARNING**
>
> *Risk of injuries! Follow all safety instructions ⇒ "1.3 Warning notes and safety norms", page 3 !*

– Reprogram the electric window, insert the radio code, set the time and, if necessary, recode the control unit with fault messages.

3.1.3 Clean battery terminals

Special tools and workshop equipment required

♦ VAG 1331



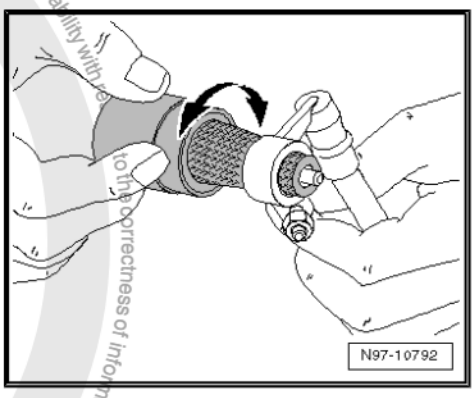
Note

Using rust remover, contact sprays or greases must be avoided because the lack of friction in the thread causes excess tightening torque and ultimately breaks the threaded joint.

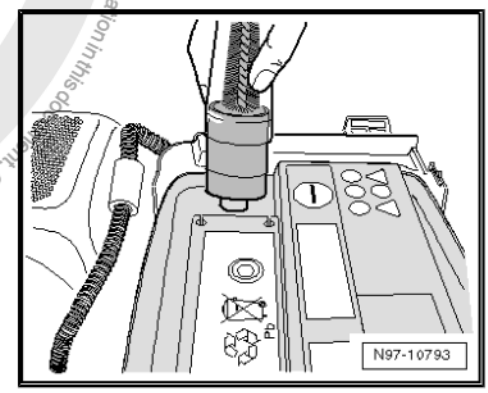
WARNING

Risk of injuries! Follow all safety instructions ⇒ "1.3 Warning notes and safety norms", page 3 !

– Disconnect the battery.
– Check battery terminals for corrosion or dirt.
– Battery terminals must be cleaned using a battery terminal steel brush in circular movements.



– Battery terminals must be cleaned using the underside of the battery terminal steel brush in circular movements.



WARNING

Risk of injuries! Follow all safety instructions ⇒ page 3 !

– Reconnect the battery and tighten the terminals to the specified torque.

Note

Ideal contact is ensured when bolted components are tightened to the specified torque after cleaning.

3.1.4 Preservation

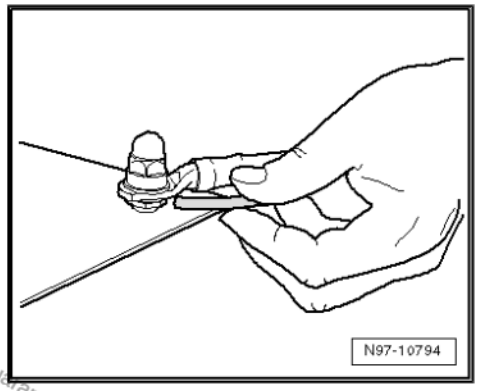
Caution

Lack of preservation leads to damages in on-board systems.

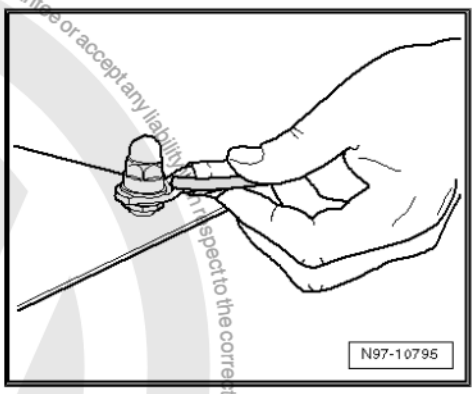
Note

- *All bolted joints must be tightened to the specified torque.*
- *The hose provided along with the preserving agent can must be used in preservation works.*
- *The preserving wax is used in cold regions.*
- *The hollow-space preserving agent is used in warm regions.*
- *Due to the capillary effect, preserving agents are automatically absorbed in affected spots.*

– Hold the nozzle under the cable eye and spray around the pins.



– Hold the nozzle over the cable eye and spray the pins and around the cable eye.



4 Lambda probe - replace

⇒ “4.1 LSF lambda probe (4 poles) - replace”, page 159

⇒ “4.2 LSU lambda probe (6 poles) - replace”, page 160

⇒ “4.3 Versions of the protection tube of unit lambda probes”, page 161

Note

- *There must not be any maintenance in lambda probe cables, since this could result in functional faults.*
- *When necessary, define the components, cable connectors or weld marking tapes based on the faulty probe's specifications.*
- *If necessary, identify the lambda probe according to the protection tube, ⇒ page 161*

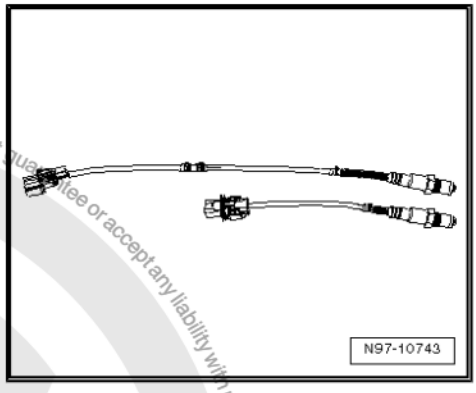
4.1 LSF lambda probe (4 poles) - replace

Note

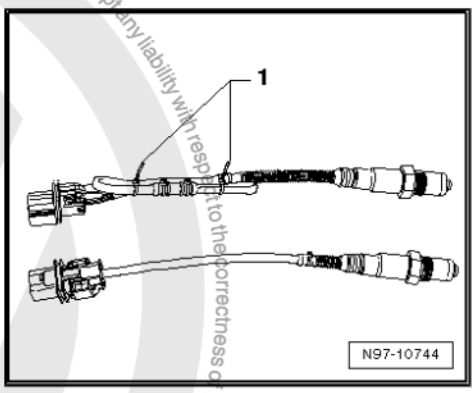
- *When necessary, define the components, cable connectors or weld marking tapes based on the faulty probe's specifications.*
- *There must not be any maintenance in lambda probe cables, since this could result in functional faults.*

– Remove the faulty lambda probe.

– Place one lambda probe next to the other and align the sensors at the same height.



– Secure the unit probe (approximately 50 - 250 mm) over the faulty probe's compartment and attach the cable connectors -1-.
– Check if the lambda probe connector housing is compatible with the side of the vehicle's electrical system.
– If necessary, replace the vehicle electrical system connector with the housing of the lambda probe connector, ⇒ “2.7 Repairing connector terminals and connectors”, page 142



Note

- *The connector housing must only be replaced in older vehicles. In new vehicles, the connector housing code is compatible.*
- *Check for proper pinout. For better visualization, individual pins of the new connector housing are marked with colour codes.*
- *Additional indications may be found in the attachment of the new lambda probe.*

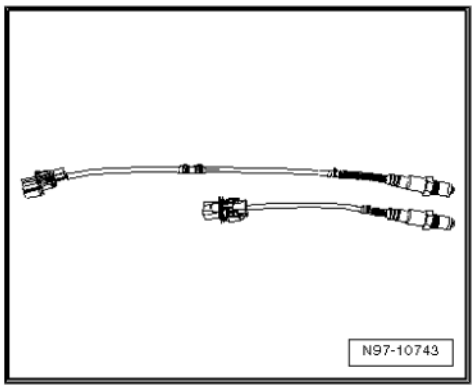
– Install the new lambda probe on the vehicle.

4.2 LSU lambda probe (6 poles) - replace

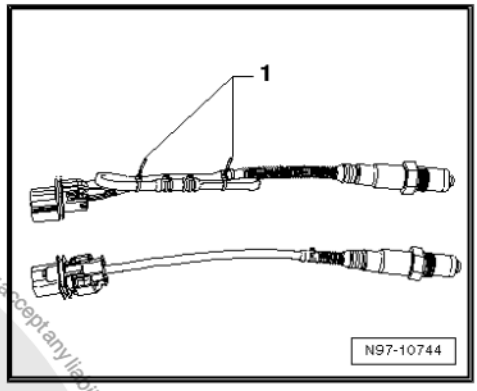
Note

- *When necessary, define the components, cable connectors or weld marking tapes based on the faulty probe's specifications.*
- *Cables must not be chipped or cut, since this will affect the lambda probe's operation.*

– Remove the old lambda probe.
– Place one lambda probe next to the other and align the sensors at the same height.



– Secure the unit probe (approximately 50 - 250 mm) over the faulty probe's compartment and attach the cable connectors -1-.
– Install the new lambda probe on the vehicle.



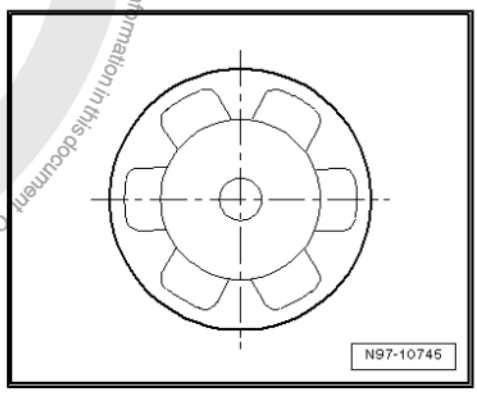
4.3 Versions of the protection tube of unit lambda probes

Note

In addition to part numbers, parts can also be identified by the protection tube.

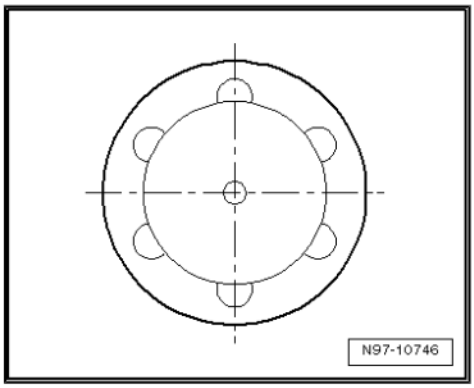
Version D1, 6 openings with 3.5 mm each

Only used for LSF lambda probes - 4 poles.



Version D2, 6 openings with 2 mm each

Used for LSF lambda probes - 4 poles and LSU lambda probes - 6 poles.



Version D4, 12 openings with 1.4 mm each

Used for LSF lambda probes - 4 poles and LSU lambda probes - 6 poles.